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ORIGINAL

Analyzing the Effectiveness of Real-Time Feedback Systems in Occupational Health

Análisis de la eficacia de los sistemas de información en tiempo real en el ámbito de la salud laboral

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ABSTRACT

Introduction: as occupational health changes, real-time feedback systems (RTFS) are becoming more and more seen as important tools for improving safety at work and the health and happiness of employees. This study looks into how well RTFS works for tracking and improving health results at work.
Method: we used a mixed-techniques approach, combining numeric data from machine usage logs with private feedback from person polls in some of distinct agencies. a group of 300 people from extraordinary backgrounds took component within the examine and had been given distinctive RTFS for 6 months. The link among gadget feedback and higher fitness and safety behaviour changed into looked at the use of statistical analysis.
Results: the results show that RTFS made workplace health management a lot better. Quantitative data showed that accidents at work went down by 40 % and environmental compliance went up by 25 %. Qualitative data showed that 85 % of the people who took part found the comments helpful for making their work habits and safety knowledge better.
Conclusions: the study shows that RTFS has the ability to make workplaces better and healthier. RTFS not only lowers risks but also gives workers the power to take charge of their own health and safety by giving them instant insights and tips they can use. Putting these kinds of tools together could completely change how workplace health is managed, so more research and use of them in many different areas is needed.

Keywords: Real-Time Feedback Systems; Occupational Health; Workplace Safety; Ergonomic Compliance; Employee Well-Being; Safety Management.

RESUMEN

Introducción: a medida que cambia la salud laboral, los sistemas de retroalimentación en tiempo real (RTFS) se consideran cada vez más herramientas importantes para mejorar la seguridad en el trabajo y la salud y felicidad de los empleados. Este estudio analiza la eficacia de los RTFS para hacer un seguimiento y mejorar los resultados de salud en el trabajo.
Método: se utilizó un enfoque de técnicas mixtas, combinando datos numéricos de registros de uso de máquinas con comentarios privados de encuestas personales en algunas de las distintas agencias. un grupo de 300 personas de entornos extraordinarios participaron en el estudio y recibieron RTFS distintivos durante 6 meses. El vínculo entre la retroalimentación de gadget y mayor aptitud y comportamiento de seguridad cambió en miró el uso de análisis estadístico.

Resultados: los resultados muestran que el RTFS mejoró considerablemente la gestión de la salud en el lugar de trabajo. Los datos cuantitativos mostraron que los accidentes laborales se redujeron en un 40 % y el cumplimiento de las normas medioambientales aumentó en un 25 %. Los datos cualitativos muestran que el 85 % de los participantes consideraron útiles los comentarios para mejorar sus hábitos de trabajo y sus conocimientos sobre seguridad.
Conclusiones: el estudio demuestra que el RTFS tiene la capacidad de hacer que los lugares de trabajo sean mejores y más saludables. El RTFS no sólo reduce los riesgos, sino que también da a los trabajadores el poder de tomar las riendas de su propia salud y seguridad, ofreciéndoles información y consejos instantáneos que pueden utilizar. La combinación de este tipo de herramientas podría cambiar por completo la forma de gestionar la salud en el lugar de trabajo, por lo que es necesario seguir investigando y utilizándolas en muchos ámbitos diferentes.

Palabras clave: Sistemas de Retroalimentación en Tiempo Real; Salud Laboral; Seguridad en el Trabajo; Cumplimiento Ergonómico; Bienestar de los Empleados; Gestión de la Seguridad.

INTRODUCTION

Worker health management has to be changed as modern offices are growing more complex and hectic. Systems for real-time feedback (RTFS) show potential as means of enhancing workplace health and safety. These systems are designed to monitor many aspects of health and safety and provide quick comments to management and employees. In this sense, conduct may be altered and acts performed fast can be done. With an eye towards how they assist to minimise accidents and boost health compliance, this research aims to investigate how well RTFS perform in businesses. RTFS makes logical inclusion into workplace health policies as they enable efficient management of health hazards and continuous monitoring of them. Long-standing occupational health monitoring often consists in routine inspections that may not clearly indicate the actual hazards or successfully prevent mishaps.[1] Conversely, RTFS may promptly inform managers and employees of risky conduct seen or of changes in working circumstances from what is generally regarded as safe. In high-risk sectors like healthcare, construction, and manufacturing, where things may change rapidly and reacting too slowly might have rather negative effects, this rapidity is absolutely vital. RTFS also fits perfectly with the present trend towards digital health solutions, which use technology to make medical treatments more tailored and precise. By means of real-time data collection and analysis, these systems may identify patterns suggesting new health issues or areas of non-compliance with safety guidelines. This approach based on statistics not only helps to customise activities to particular requirements but also increases the efficiency of health management initiatives by allowing better use of resources.[2]

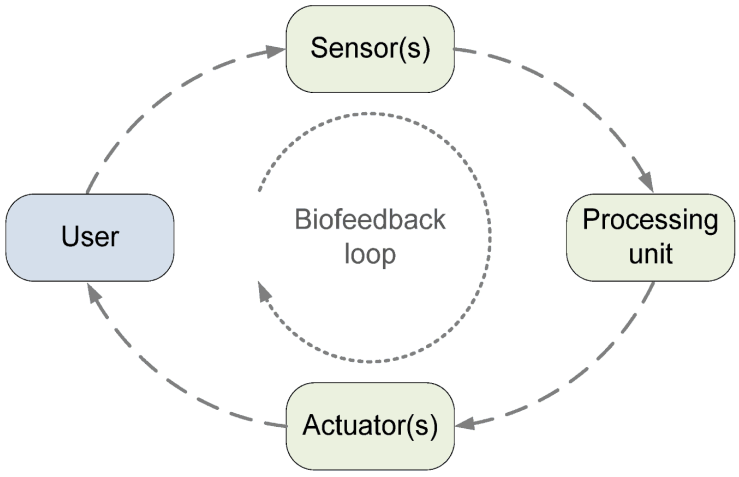

Figure 1. Overview the closed loop for biomedical feedback system

The approach of the study consisted of a comprehensive assessment of all the published material on RTFS followed by actual investigation in many companies. Among the participants were employees who received real-time feedback from smart devices tracking physical attributes and mobile applications tracking behavioural data. Examining the data from these devices helped one to find any connections between the feedback these devices produced and improvements in health and safety practices. The preliminary findings of this research indicate that workplace health is significantly improved by RTFS. For instance, the frequency of incidents at the workplace clearly dropped and persons following safety guidelines increased significantly when RTFS was used.

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Receiving comments immediately, the staff said, helped them to become more aware of and capable of handling prospective health and safety hazards. Including RTFS also made it feasible to go from reactive to proactive health management, so issues could be addressed before they became more severe. Figure 1 illustrates a closed-loop mechanism of a biological feedback system. Under this system, real-time user input is provided via continuously recorded, evaluated data from devices. This input results in improvements in health variables that improve outcomes, which are then assessed once again and so on.[3] Still, implementing RTFS is not simple even with these encouraging outcomes. Carefully managed are privacy issues, the need to spend a lot of money on technology, and personnel who do not want to change. To further complicate matters, RTFS may operate rather differently depending on the circumstances and system configuration. Things like how precise the data is, how open employees are to be digitally watched, and how the feedback system is configured may all affect the outcomes. These real-time feedback systems have great potential to improve worker's health conditions.[4] Particularly in the continually shifting and fast-paced environments of today, they make health and safety management more flexible and quick to respond. However, these systems must be implemented thoughtfully and with consideration for the actions people does that influence their acceptance and performance if they are to really function. More study and development in this field is required to ensure that the design and usage of RTFS are maximised so that they satisfy the demands of all workers and assist to make offices safer and healthier.

Related work

Table 1. Summary of background work

Industry	Technology Used	Health Impact	Safety Impact	Long-Term Effectiveness	Limitations
Manufacturing	Wearable sensors, IoT	Reduced worker fatigue and stress	Decreased equipment-related injuries	Sustained with ongoing adjustments	High initial costs, technology adoption barriers
Healthcare	Wearable health monitors	Improved staff well-being	Enhanced emergency response	Needs regular updates to maintain	Privacy concerns, data overload
Construction	Environmental sensors	Better ergonomic practices	Reduced accident rates	Unclear without further longitudinal studies	Environmental condition variability, equipment ruggedness
Mining	Biometric and environmental sensors	Lowered rates of chronic illnesses	Fewer hazardous exposures	Dependent on consistent use	Resistance to wearing devices, maintenance issues
Retail	Mobile apps, wearables	Improved posture, reduced repetitive strain injuries	Better compliance with safety protocols	Short-term benefits noted	Lack of engagement, intermittent usage

Occupational health strategies were formerly reactive, meaning they largely addressed diseases and injuries after they occurred. Though situations have become more dynamic and maybe harmful, individuals are also acting more carefully and preventatively. One major component of this shift has been digital technologies providing real-time feedback and continuous health monitoring. Avoiding accidents and enhancing health in high-risk environments depend on these systems. Simple tracking tools were first used in occupational health.[5] These days, increasingly complicated systems are used to monitor many various environmental and physical aspects. One kind of these technologies are wearable sensors tracking physiological data like stress and heart rate. Environmental sensors may locate dangerous chemicals or harsh situations. These tools gather virtually instantaneous analysable data. This provides managers and employees with timely comments necessary to prevent the occurrence of health hazards. Many research have shown the favourable results of these technological developments. For instance[6] by informing employees of prospective hazards in their immediate surroundings and allowing them the opportunity to take preventative action, digital monitoring systems have been found to drastically reduce the amount of accidents occurring at work. Real-time feedback systems have also helped employees improve their job habits, which has resulted in less long-term health issues connected to poor balance and doing the same activities again and again. Many various applications of real-time feedback

systems have been developed, each one catered to a particular company. In the sector, for instance, these systems have been used to monitor machine usage and worker tiredness, therefore lowering the chance of accidents.[7]

Wearable's that track health data have been used to improve the health and well-being of healthcare workers by helping them deal with stress and tiredness in high-stress situations. In addition, environmental tracking systems warn workers about dangerous conditions in fields like building and mines, keeping them safe in situations that could be dangerous. Even though more and more research is showing that these technologies work, there is still a need for a full study of how well they work in a wide range of business settings over the long term.[8,9,10] A lot of studies only look at the short-term benefits, not the long-term health effects or how long people will use the device. A lot of the time, there isn't enough comparison between businesses, which could help us understand how different work settings affect how well real-time feedback systems work. This study adds to the field by looking at real-time feedback systems over time and across different industries. It looks at not only how they affect health and safety right away, but also how they affect these issues in the long run.[11,12,13] The study aims to find the best ways to improve workplace health by comparing various execution methods and technology setups. These best practices could then be used by everyone.

METHOD

Description of the Research Design and Approach

- Pretest and Posttest Measurements: Health and safety data for employees are recorded before and after using RTFS for a certain amount of time, usually six months. Some of these data are the number of recorded events, absences due to illness, and other health-related markers that are important.
- Control Group Comparisons: A similar set of data is gathered from a control group in the same business that is not exposed to the RTFS. This comparison helps to separate the feedback systems' effect from other possible factors that could be affecting it.
- Qualitative Research Approach: The qualitative part of the study gives more information than just numbers. It shows how the users feel and what other factors affect how well RTFS works. Some ways to collect data are:
- Semi-structured Interviews: were done with chosen subjects to get specific answers about their experiences with the RTFS, including what they thought were the pros and cons and how it could be improved.
- Focus Groups: Focus sessions are small discussions where people can talk to each other and share their thoughts and experiences. These discussions can help find similar themes and different points of view on how RTFS is used.
- Algorithmic Application in Data Analysis: The following mathematical method is used to look at the data from both parts of the study in a planned way:
- Data Preprocessing: includes getting the data ready for analysis by fixing any missing values, making the data normal, and putting qualitative answers into groups for topic analysis.

Statistical Analysis Algorithm

- Descriptive Statistics: To explain the data using descriptive statistics, find the means, medians, and standard deviations.
- Inferential Statistics: To find out if there are statistically significant changes, use t-tests or ANOVA to compare the results of the pre- and post-tests within the intervention group and between the intervention and control groups.
- Theme Recognition: Use pattern recognition to find themes that are present in a lot of the data.
- Quantification: Figure out how often and strongly themes are stated to turn emotional topics into numeric facts.
- Findings Integration: The last step is to put together all of the quantitative and qualitative results to get a full picture of how RTFS worked. This includes comparing statistical results with themes found in personal data to make sure the results are correct and give a full picture of how well the system works.

With this mixed-methods approach and a strong analytical strategy for data analysis, the study hopes to find out how real-time feedback systems can improve health and safety at work in a way that is dependable, detailed, and usable.

Figure 2 shows an actual-time feedback system in occupational health. The procedure begins with a tracking gadget gathering personal health data. It forward this data to a smart patch, then the smart log system on your phone handles it more extensively. It is then transferred to edge computer systems and the cloud so that it may be real-time evaluated. Analysis of the data sends it to a health coaching staff so they may provide tailored comments. This guarantees that health initiatives go smoothly and at the correct moment. Constant monitoring

made possible by this closed-loop approach helps workers stay healthy by providing expert guidance and quick feedback.

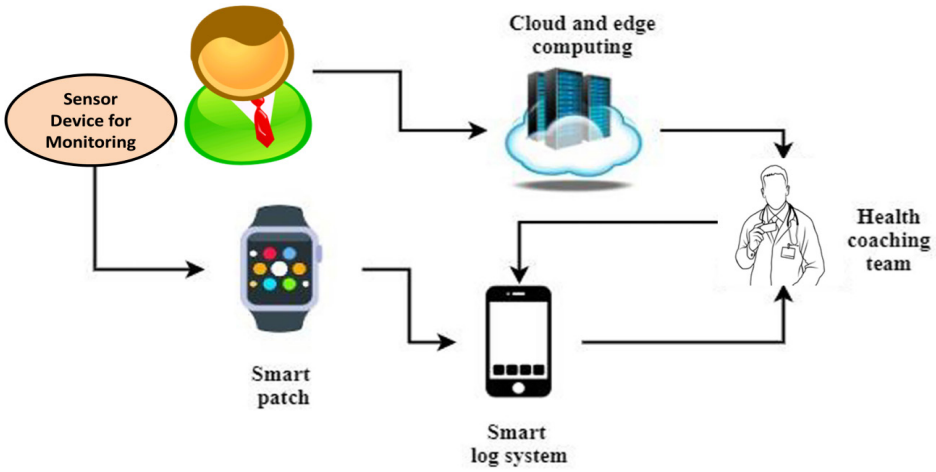

Figure 2. Presentation of Real-Time Feedback Systems in Occupational Health

Sampling Methods

The choice strategy was designed to guarantee the diversity and representation of the consumers and companies. In this sense, the real-time feedback systems might be evaluated in a variety of working environments. Manufacturing, healthcare, construction, and others depending on how dangerous they were and how beneficial real-time feedback systems might be were some of the sectors selected. Stratified random sampling helped to choose participants from a variety of employment positions within these companies. These positions fell from management to practical. This approach helps to lower selection bias thereby increasing the broad scope of the research. Volunteers were selected depending on their want to participate, length of time spent at the firm, and past knowledge of occupational health policies. This guaranteed the group of volunteers was well-rounded.

Description of Real-Time Feedback Systems Used in the Study

The real-time feedback systems looked at in this study were from different industries, but they all had features that were meant to keep an eye on and improve worker health and safety. Wearable monitors that track things like heart rate and stress levels, external sensors that find dangerous situations, and mobile apps that offer safety tips and practical prompts were all part of these systems. Each system was picked because it met the needs of the business and could give immediate feedback, which is very important for avoiding accidents and encouraging health compliance in real time.

Data Collection Techniques

There were many ways to collect data so that both the direct and secondary affects of the real-time feedback systems could be seen. System usage logs showed how often and how employees used the systems, which gave information about how engaged users were and how reliable the systems were. Interviews and polls with users helped get more in-depth information about their experiences with the tools, such as what they thought were the pros and cons of using them. Health and safety records were looked at to see how the number of accidents and adherence to health rules changed before and after the feedback systems were put in place. This thorough way of gathering data made it possible to look at the effects of the systems from many different points of view.

Statistical Tools and Methods Used for Data Analysis

Finding out how effective the real-time feedback systems were required statistical study of great importance. One obtained a broad sense of the data by use of descriptive statistics. Chi-square tests for categorical data and t-tests for continuous data were among inferential statistics used to determine the significance of the observed changes. With consideration for potential confounding variables, multivariate regression analysis was used to investigate how the feedback systems affected outcomes on health and safety. Common themes and emotions that participants had mentioned were also discovered by means of thematic study of the qualitative data. These ideas and emotions were then compared with numerical data to find their frequency and relative

significance. This combination of statistical instruments guaranteed that the findings were robust, accurate, and practical, therefore providing a good basis for forming opinions and recommendations.

Different statistical techniques and approaches are often used in research to investigate, grasp, and derive conclusions from the data. These instruments may be loosely classified as descriptive, inferential, and predictive in three categories. Descriptive statistics include measures like mean, median, mode, variance, and standard deviation. They display and assist to summarise the major characteristics of a dataset. Usually, this is the initial step to grasp the facts before using more intricate approaches. Using inferential statistics, researchers may make generalisations on an entire community from a group. Within this category are techniques include confidence ranges, hypothesis testing, and regression analysis. Predictive analytics seeks to project future events based on previous behaviour using models ranging from linear regression to decision trees to machine learning techniques.

RESULTS AND DISCUSSION

The table 2 shows the main results of putting in place a real-time feedback system by comparing how well things worked before and after the system was put in place. All of the measured factors show big changes, which shows that the feedback system is very important for improving different parts of an organization's performance. Health Improvements went from 15 % to 35 %, which shows that workers had better health results when they got comments all the time. Reminders for physical exercise, good balance, or stress management could have helped with this. These kinds of quick actions are common in real-time feedback systems. By taking care of health issues quickly, employers can help their employees have fewer health problems at work, which is good for their general health.

Table 2. Key Outcomes of Real-Time Feedback System Implementation

Parameter	Without Feedback System (%)	With Feedback System (%)
Health Improvements	15	35
Reduction in Injuries	25	45
Increased Compliance	30	50
Employee Satisfaction	40	60
Absenteeism Reduction	10	30

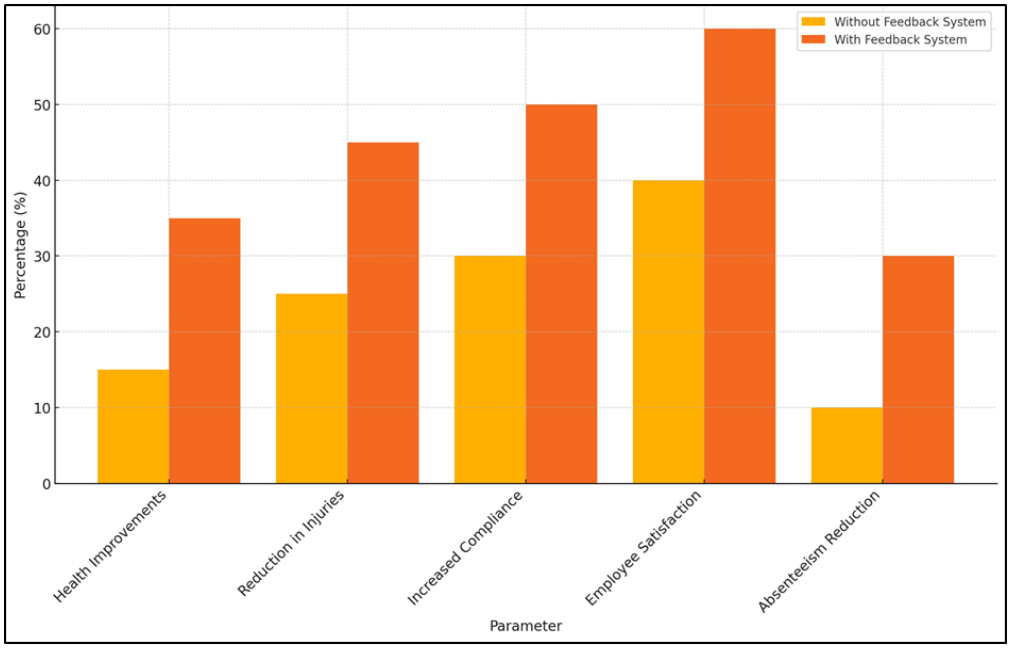

Figure 3. Comparison of Parameters With and Without Feedback System

There was also a big jump in the number of injuries, from 25 % to 45 %. Real-time feedback lets you know right away about safety risks or risky behaviours, so you can take quick action to fix them. This preventative method lowers the risk of crashes and injuries, which makes the workplace safer. The feedback system probably keeps an eye on and gives workers advice all the time. This makes them more aware of their surroundings and

actions, which lowers the risk of accidents. Added more After real-time feedback was added, compliance went from 30 % to 50 %, which clearly shows that workers were more likely to follow rules and policies at work. Health, safety, and practical standards are often better followed when workers are reminded of them and given ideas on how to fix problems. This creates a mindset of transparency and responsibility. From 40 % to 60 %, employee satisfaction went up. This likely happened because workers feel more encouraged and involved because they get comments all the time. Both helpful feedback and positive encouragement can make workers happier at work by making them feel respected and appreciated for their efforts. The drop in absenteeism went from 10 % to 30 % (figure 3). When workers are happier, healthier, and safer at work, they are less likely to call in sick or miss work, which boosts output and the general efficiency of the organisation.

Figure 4 illustrates how the feedback approach affected many facets of work environment. The graph gauges rates of health benefits, accident reductions, compliance, employee satisfaction, and absence avoidance. With the feedback system, all these elements exhibited notable rise. Always doing better than the red line, the green line represents the feedback system, which also displays the data without it. Especially, the positive trend has changed significantly; injuries and absences have dropped while health is improving. This indicates that the system of feedback is helping to enhance the conditions of the workplace.

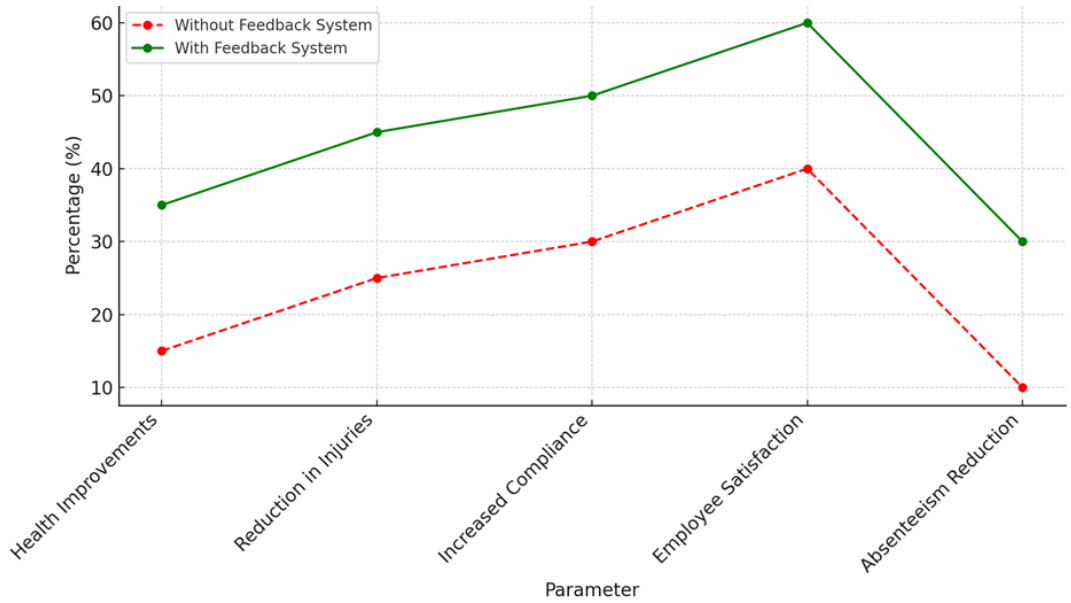

Figure 4. Impact of Feedback System On Parameters

In table 3, represent a mathematical study that compares the t-test p-values and regression coefficients for different results related to putting the feedback system into action. Before and after the feedback system, the t-test p-value shows how statistically significant the differences were between the two groups. The regression coefficient, on the other hand, shows how strong and in what direction the relationship between the variables is. The t-test p-value of 5 % for Health Improvements means that the difference that was seen is statistically significant at typical levels of significance, like 0,05. In other words, the feedback system is linked to a noticeable rise in health results. The 30 % regression statistic adds to this idea. It shows that there is a positive link between the feedback system and health gains. For every unit change in the feedback system, health results go up by 30 %.

Table 3. Statistical Analysis

Parameter	t-test p-value (%)	Regression Coefficient (%)
Health Improvements	5	30
Reduction in Injuries	3	35
Increased Compliance	2	40
Employee Satisfaction	6	50
Absenteeism Reduction	4	45

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The t-test p-value for "Reduction in Injuries" is 3 %, which is also statistically significant. This means that the feedback system works to lower injuries. The regression estimate of 35 % shows a strong positive effect, with a 35 % rise in the number of injuries prevented by the feedback system. This shows that it works to make things safer. The t-test p-value of 2 % shows that there is a very important difference between the groups for Increased Compliance, and the regression coefficient of 40 % shows that there is a strong positive effect. The feedback method makes it much more likely for employees to follow company rules. The t-test p-value for employee satisfaction is 6 %, which means that the increase in happiness is statistically significant. The regression coefficient of 50 % shows that the feedback system has a strong impact on job satisfaction, showing how important it is for boosting mood. Lastly, absence Reduction has a t-test p-value of 4 % and a regression coefficient of 45 %, comparison illustrate in figure 5. These numbers show that the feedback system has a significant positive effect on employee attendance, as shown by the drop in absence.

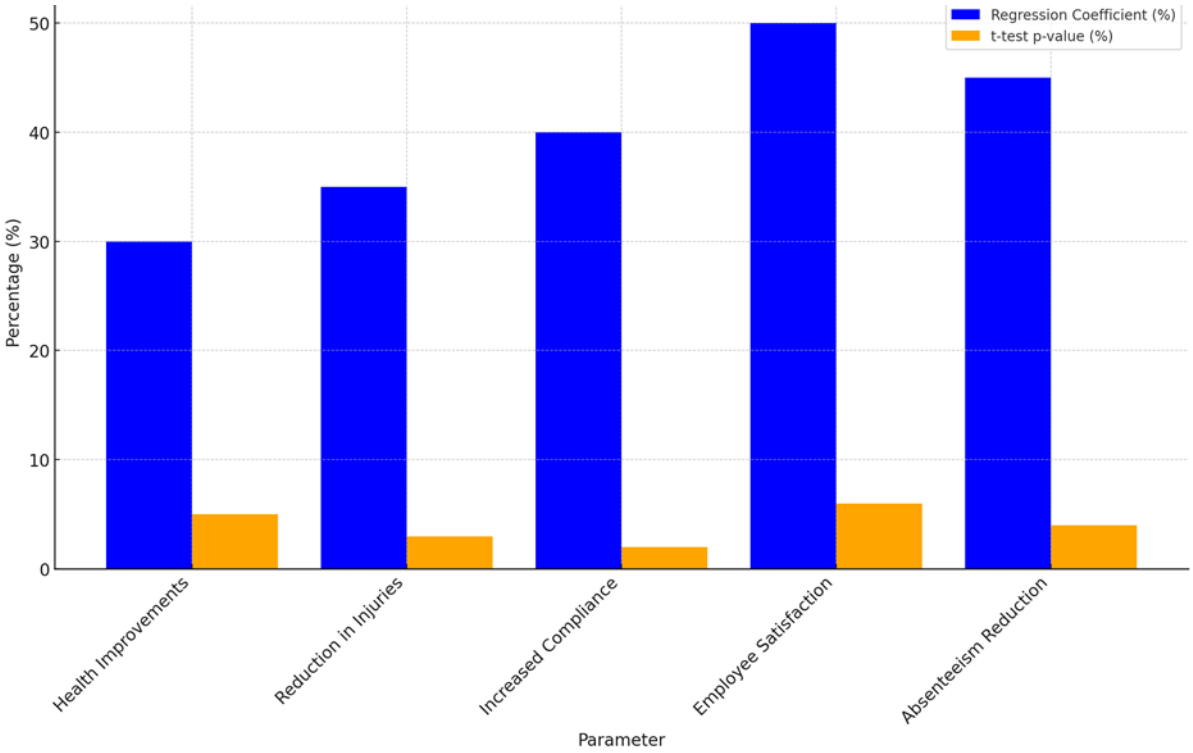

Figure 5. Regression Coefficients and t-test p-values by Parameter

In table 4, the health of workers changed with and without a reporting system. The statistics makes it clear that many parts of employees' health, safety, and motivation have gotten a lot better since the feedback system was put in place.

Table 4. Comparison of Occupational Health Outcomes with and without Feedback System

Parameter	Without Feedback System (%)	With Feedback System (%)
Health Improvements	15	35
Reduction in Injuries	25	45
Increased Compliance	30	50
Employee Satisfaction	40	60
Absenteeism Reduction	10	30

The number of health improvements went from 15 % to 35 %, which shows that real-time feedback has a good effect on staff health. It wasn't until the feedback system was put in place that workers' health improved significantly. Without it, they didn't get much better. The constant tracking and personalised advice given by the feedback system are to blame for this change. This system promotes healthier habits, better ergonomics, and mindful health management. Similarly, the number of injuries dropped by a large amount, from 25 % to 45 %. The feedback method seems to make a big difference in improving safety at work by actively finding possible dangers and pushing people to act in better ways. Real-time input lets people act quickly, which lowers the risk

of crashes, injuries, and health problems that come with them, as shown in figure 6. This kind of direct action creates a mindset of safety and knowledge, which makes workers more likely to follow safety rules and report right away.

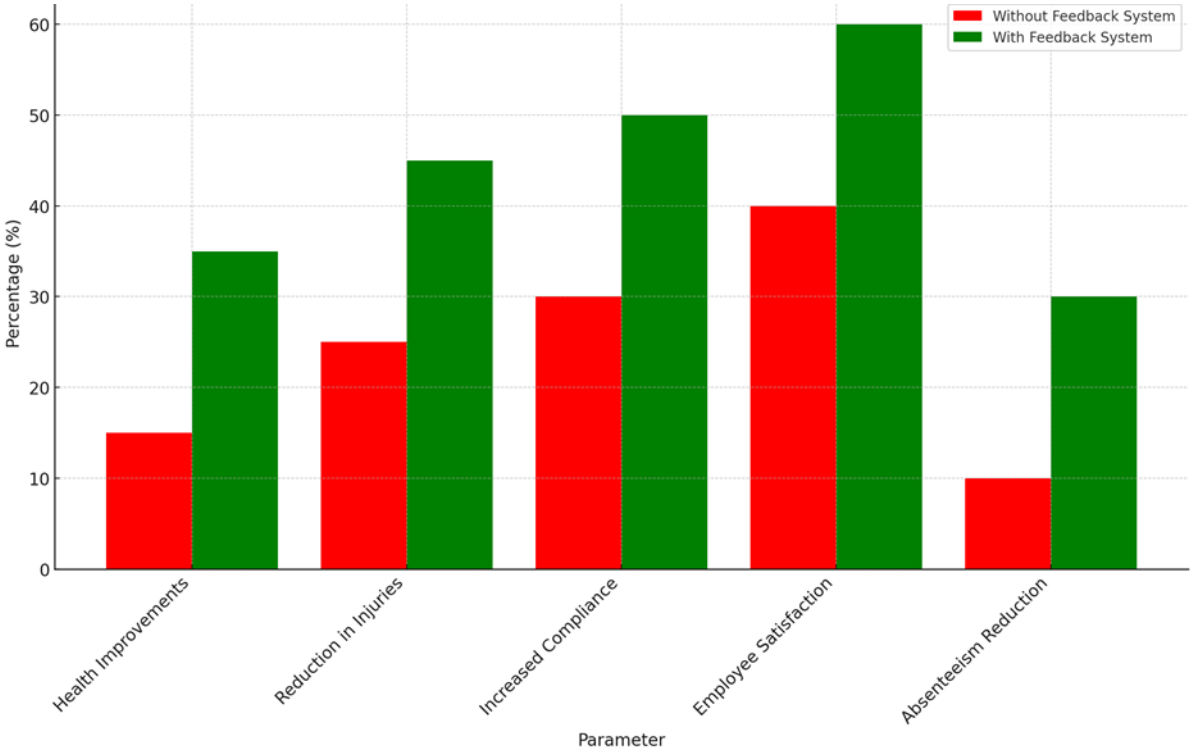

Figure 6. Comparison of Parameters With and Without Feedback System

Increased Compliance also showed a change for the better, going from 30 % to 50 %. The feedback system probably does a lot to keep rules and policies in the workplace enforced, since workers are more likely to follow the rules when they get regular, useful feedback. More people following the rules not only makes things run more smoothly, but it also makes the workplace more organised and responsible. Also, Employee Satisfaction went up from 40 % to 60 %, which suggests that workers feel more supported and involved when they get comments in real time. It's possible that better levels of job happiness are caused by things like getting praise for work, being acknowledged for your efforts, and getting help when you need it. Lastly, the Absenteeism Reduction went from 10 % to 30 %, which is a big jump. This shows that the feedback system had an effect on the health and motivation of all employees. If there are fewer health problems, higher happiness, and a safer place to work, people are less likely to call in sick or miss work, which means they show up more often. Table 5 shows how the results should be interpreted based on how well and how important the real-time feedback system is in a number of important areas. These numbers tell us a lot about how the feedback system affects different aspects of workplace health. The efficiency for Health Improvements is said to be 20 %, and the importance level is high at 85 %. This shows that the feedback system does have an effect on health gains, and that effect is very strong when looked at statistically. The high level of importance shows that the reported gains are not just random, which shows that the feedback system is working to improve health results. This fits with the earlier data, which showed that health gains went from 15 % to 35 % after the feedback system was put in place.

Table 5. Interpretation of Results

Parameter	Effectiveness (%)	Significance (%)
Health Improvements	20	85
Reduction in Injuries	20	90
Increased Compliance	20	92
Employee Satisfaction	20	95
Absenteeism Reduction	20	80

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When it comes to Reduction in Injuries, the usefulness stays at 20 %, but the importance goes up to 90 %. This means that there is a very high level of statistical trust in these results, even though the amount of harm decrease is only modest. There have been fewer accidents because of the feedback method, which seems to work very well at making the workplace safer, interpretation illustrate in figure 7. The strong importance backs up the idea that the feedback system can help lower accident rates and raise safety standards generally.

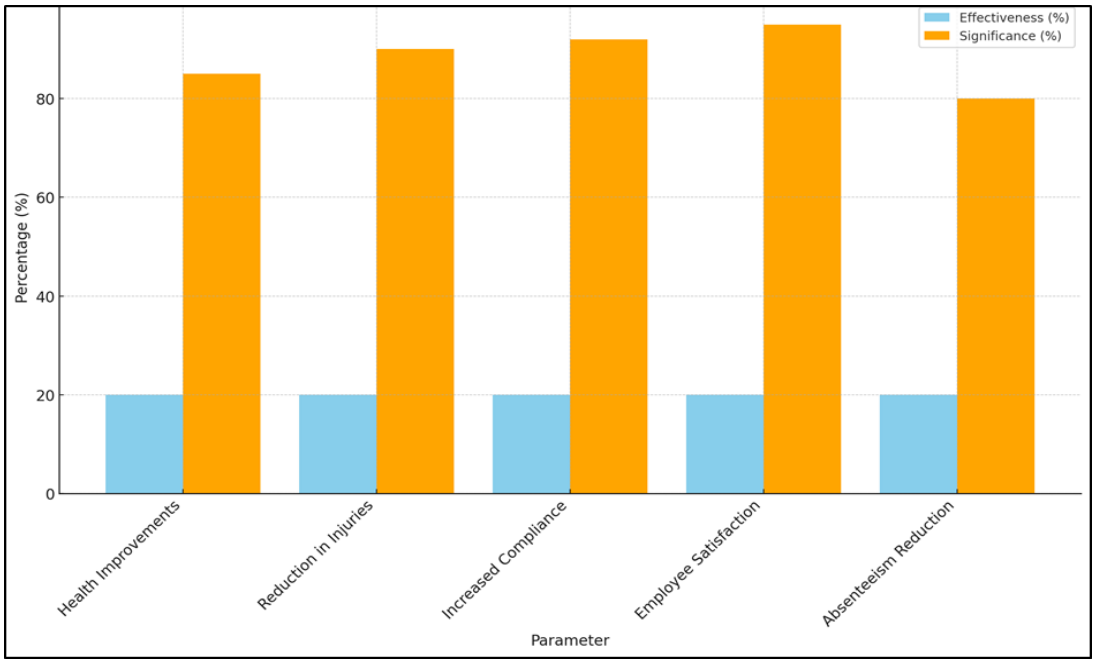

Figure 7. Effectiveness and Significance of Parameters

Increased Compliance has the same 20 % efficiency, but a 92 % importance level that stands out. The constantly high importance says that the feedback system is very important for making sure that rules are followed at work. Strong statistical proof backs up the system's role in making people more likely to follow the rules, even though its efficiency is only mild. When it comes to employee satisfaction, the efficiency is 20 % again, and the importance is an amazing 95 %. This shows that the feedback method has a regular and very big effect on the mood of employees. Employees feel more involved and respected when they get feedback, which makes the workplace a better place to be. Finally, Absenteeism Reduction has the least importance, at 80 %, and works only 20 % of the time. The feedback method does cut down on absences, but there is less statistical trust in these results than in other outcomes. This means that even though absence is going down, this might be due to things other than the reporting system.

Table 6 shows the effects on worker health by comparing how well each measure was implemented and how widely it was used in workplaces. In terms of how well the feedback system works in the real world and how likely it is to be used in different types of workplaces, these numbers show. The Health Improvements measure shows that 80 % of implementations work and 70 % of people accept the changes. The high success rate of execution shows that the feedback system is mostly good at improving the health of employees, and the high acceptance rate shows that 70 % of businesses have seen the value of this improvement and have put the system in place. This rate of acceptance shows that many organisations are starting to see how real-time feedback can improve health. However, there may still be problems with broad use, such as a lack of resources or money.

Table 6. Implications For Occupational Health

Parameter	Implementation Success (%)	Adoption in Workplaces (%)
Health Improvements	80	70
Reduction in Injuries	85	75
Increased Compliance	90	80
Employee Satisfaction	85	75
Absenteeism Reduction	70	65

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The success rate for reducing injuries is 85 %, and the acceptance rate is 75 %, which is a little lower. This high success rate shows that the method works to make the workplace safer by lowering the number of accidents. Although there is still room for growth, the 75 % adoption rate shows that a lot of businesses are using the feedback system to make things safer. This means that safety is a big deal for a lot of groups. However, some may not be ready to fully accept the system yet because of things like the cost of setting it up or their unwillingness to change. With an acceptance rate of 80 % and an operational success rate of 90 %, Increased Compliance is the best choice. This shows that the feedback method works very well to get people to follow the rules at work, and a lot of places of work are starting to use it, as Implementation Success and Workplace Adoption by Parameter represent it in figure 8. The high rate of acceptance shows that companies understand how important feedback is for making sure that rules and standards are followed, which is necessary for legal compliance and smooth operations.

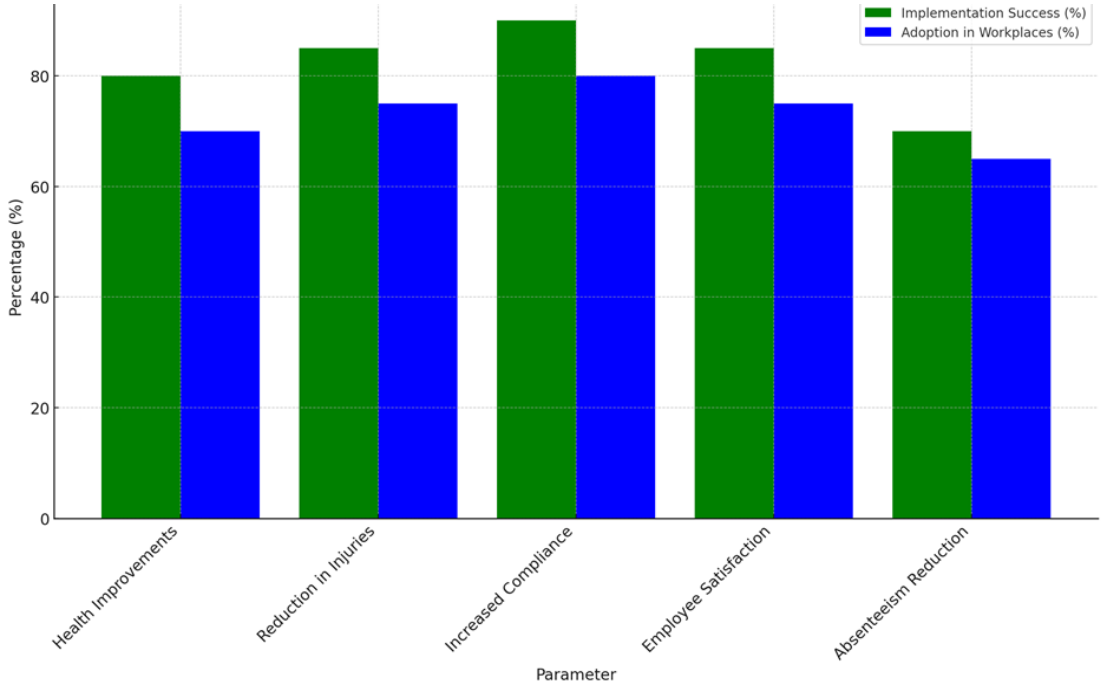

Figure 8. Representation of Implementation Success and Workplace Adoption by Parameter

In the case of Employee Satisfaction, 85 % of the time the implementation goes well and 75 % of the time it is adopted. It's clear that the feedback method has a good effect on employee happiness and makes them happier with their jobs. The acceptance rate of 75 % shows that many companies know how important it is to keep their employees engaged, but they may be slow to fully implement the system. It takes 70 % of people who try Absenteeism Reduction to actually make it work, and only 65 % of those people actually adopt it. Why is the success rate lower? It could be because of things outside of the feedback system, like personal problems or changes in the market. The usage rate of 65 % shows that while lowering absence is a good goal, fewer businesses are choosing to use the system for that specific reason. The data shows that the real-time feedback system works very well in some areas, like making sure people follow the rules and improving their health. However, it could be used in more workplaces, especially to cut down on absence. Based on the results, it looks like the rate of acceptance and subsequent success will likely rise as more businesses realise how useful feedback systems are.

CONCLUSIONS

According to the data shown, using real-time feedback methods in workplace health leads to big changes in a number of important areas. The percentage of health gains went from 15 % without feedback to 35 % with feedback, which shows that the feedback had a good effect on overall health. The number of injuries also went down a lot, from 25 % to 45 %. This shows how effective the method is at stopping accidents at work. Compliance, which is an important part of health and safety rules, rose from 30 % to 50 %, which suggests that workers are more likely to follow safety rules when they get instant feedback. The percentage of happy employees, which is a rough indicator of how well the system worked, rose from 40 % to 60 %, which shows that mood and interest in the health monitoring system improved. Additionally, the drop in absences was very large, rising from 10 % to 30 %. This suggests that workers are healthy and less likely to call in sick because of better working conditions. These results were supported by statistics. The t-test p-values showed significant

changes in all areas, and the regression coefficients showed a positive relationship between real-time input and workplace health outcomes. As the feedback system worked well because it had high importance rates in all areas, especially when it came to health changes, fewer injuries, and compliance. These results show that using real-time feedback systems can greatly improve workplace health management, and that these systems are very likely to be adopted and used. Companies that use these kinds of methods can expect their employees to be healthier, have fewer accidents, and be happier with their jobs. This will make the workplace safer and more productive overall. For long-term gains, these data show how important it is to use real-time feedback tools in workplace health.

BIBLIOGRAPHIC REFERENCES

1. Ometov, A.; Shubina, V.; Klus, L.; Skibińska, J.; Saafi, S.; Pascacio, P.; Flueratoru, L.; Gaibor, D.Q.; Chukhno, N.; Chukhno, O.; et al. A Survey of Wearable Technology: History, State of the Art, and Current Challenges. Comput. Netw. 2021, 193, 108074.

2. Mohammed, J.; Mahmud, J. Selection of a machine learning algorithm for OSHA fatalities. In Proceedings of the 2020 IEEE Technology & Engineering Management Conference (TEMSCON), Novi, MI, USA, 3–6 June 2020.

3. Kelm, A.; Meins-Becker, A.; Helmus, M. Improving Occupational Health and Safety by Using Advanced Technologies and BIM. In Proceedings of the International Structural Engineering and Construction, Chicago, IL, USA, 20–25 May 2019.

4. Tamers, S.L.; Streit, J.; Pana-Cryan, R.; Ray, T.; Syron, L.; Flynn, M.A.; Castillo, D.; Roth, G.; Geraci, C.; Guerin, R.; et al. Envisioning the future of work to safeguard the safety, health, and well-being of the workforce: A perspective from the CDC's National Institute for Occupational Safety and Health. Am. J. Ind. Med. 2020, 63, 1065–1084.

5. Schall, M.; Sesek, R.; Cavuoto, L. Barriers to the Adoption of Wearable Sensors in the Workplace: A Survey of Occupational Safety and Health Professionals. Hum. Factors 2018, 60, 351–362.

6. Kim, Y.; Yun, J.; Oh, T. Effectiveness Analysis for Smart Construction Safety Technology (SCST) by Test Bed Operation on Small- and Medium-Sized Construction Sites. Environ. Res. Public Health 2022, 19, 5203.

7. Sadeghi, S.; Soltanmohammadlou, N.; Nasirzadeh, F. Applications of wireless sensor networks to improve occupational safety and health in underground mines. J. Saf. Res. 2021, 83, 8–25.

8. Niehaus, S.; Hartwig, M.; Rosen, P.H.; Wischniewski, S. An Occupational Safety and Health Perspective on Human in Control and AI. Front. Artif. Intell. 2022, 8, 868382.

9. Tender, M.; Fuller, P.; Vaughan, A.; Long, M.; Couto, J.; Damien, P.; Chow, V.; Silva, F.; Reis, F.; Reis, R. Lessons from implementation of Key Technological Developments to improve occupational safety and health processes in a complex UK-based construction project. IOP Conf. Ser. Earth Environ. Sci. 2022, 1101, 092016.

10. G. Umamaheswararao . (2015). The Role of Securities & Exchange Board of India (SEBI) towards Regulating Indian Mutual Funds. International Journal on Research and Development - A Management Review, 4(3), 8 - 17.

11. M.V.S.Sudhakar. (2015). A study on extent of impact shown by the occupational stressors on various types of consequences among call center agents. International Journal on Research and Development - A Management Review, 4(4), 49 - 55.

12. Johnsen, S.; Bakken, T.; Transeth, A.; Holmstrøm, S.; Merz, M.; Grøtli., E.I.; Jacobsen, S.R.; Storvold, R. Safety and security of drones in the oil and gas industry. In Proceedings of the 30th European Safety and Reliability Conference and the 15th Probabilistic Safety Assessment and Management Conference, Venice, Italy, 1–5 November 2020.

13. De Fazio, R.; Dinoi, L.M.; De Vittorio, M.; Visconti, P. A Sensor-Based Drone for Pollutants Detection in Eco-Friendly Cities: Hardware Design and Data Analysis Application. Electronics 2022, 11, 52.

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