

## ROLE OF RISK AWARENESS, MANAGEMENT IN SUCCESS OF IMMUNIZATION PROGRAM WITH MODERATING EFFECT OF EFFECTIVENESS OF TRAINING PROGRAM

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### Abstract

The success of immunization programs is essential to public health, particularly in combating infectious diseases globally. However, these programs often face significant challenges due to various risks, including cultural and religious barriers, misinformation, and human error. This research aims to investigate the role of risk awareness and risk management in the success of immunization programs, with a focus on the moderating effect of training program effectiveness. The study was conducted among healthcare workers in District Karak, involved in the Expanded Program on Immunization (EPI), with a sample size of 338 participants. The study employed a field-based approach with data collected through self-administered questionnaires, focusing on key variables such as risk awareness, risk management, training effectiveness, and the success of immunization efforts. The results show a strong correlation between risk awareness, risk management, and the success of immunization programs, with risk management acting as a mediator and training effectiveness strengthening the relationship between risk awareness and risk management. Statistical analysis, including multiple regression and mediation analysis, confirms the significant impact of these variables on the success of immunization programs. The study highlights the importance of increasing risk awareness among healthcare professionals, improving risk management practices, and enhancing training programs to ensure the success of immunization campaigns, particularly in regions facing high levels of vaccine hesitancy. These findings provide valuable insights for healthcare policymakers and practitioners in developing strategies to improve immunization program outcomes globally.

## INTRODUCTION

Humanitarian aid organizations increasingly operate in complex emergencies, where violent incidents threaten not only the lives of humanitarian workers but also the provision of life-saving aid. These incidents disproportionately impact the most vulnerable populations in need, exacerbating their challenges (Hoseininezhad, Makui, & Tavakkoli-Moghaddam, 2021). In healthcare, professionals run immunization programs to combat the spread of infectious diseases and save lives. However, human error remains a significant threat to the success of healthcare programs. Despite the growing prevalence of training and awareness programs, the lack of sufficient data proving their effectiveness in reducing errors remains a challenge (Simsekler, Gurses, Smith, & Ozonoff, 2019).

Healthcare institutions are recognized as high-risk environments, lagging behind other sectors in risk management development and application (Gerard, Imbert, & Orkin, 2020). The initial focus of healthcare risk management efforts was primarily on patient safety and reducing medical errors, which jeopardized organizational capacity to fulfill its mission and avoid financial repercussions (Gerard et al., 2020). Over time, however, risk management has evolved to account for more complexities due to advances in healthcare technology, cybersecurity concerns, the rapid progression of medical science, and constantly changing regulatory and legal frameworks (Rana, Wickramasinghe, Bracci, & Management, 2019).

Effective risk management in healthcare settings depends on awareness of potential risks. Understanding these risks is crucial in taking preventive actions and mitigating potential damage (Salguero-Caparrós, Pardo-Ferreira, Martínez-Rojas, & Rubio-Romero, 2020). A robust safety culture in an organization is grounded in how well its employees are educated about risks and are able to recognize them (Morita et al., 2011). Proper risk awareness among healthcare personnel is an essential factor in promoting safer practices and preventing avoidable errors.

Healthcare risk management involves systematic processes designed to identify, assess, and mitigate risks that could potentially harm the institution, its staff, and patients (Bernard et al., 2018). The main

objective of risk management is to reduce or eliminate hazards that could impact the healthcare facility's operations and its ability to deliver safe and high-quality care (Rana et al., 2019). Effective risk management is multifaceted, including steps like risk identification, evaluation, and control, which aim to minimize the occurrence of hazardous events and to limit their potential impact.

One key element in effective risk management is ensuring that controls are implemented to address identified risks. This step involves taking action to reduce the severity or likelihood of risks that threaten organizational objectives. The initial stages of risk management—such as awareness, identification, and evaluation of risks—set the foundation for the next crucial step of risk control (Bernard et al., 2018). For healthcare systems to be successful, risk awareness must be systematically incorporated into organizational practices, facilitating both risk prevention and response when risks materialize.

Despite the increasing awareness of risk, healthcare professionals often fail to effectively manage risks due to a lack of proper training and awareness. Research has shown that risk awareness plays a central role in improving healthcare outcomes, particularly in settings that are prone to system failures or hazards (Blume et al., 2020). Human error is particularly evident in healthcare immunization programs, where improper handling and administration of vaccines can undermine the effectiveness of these life-saving initiatives. For instance, improper storage of vaccines or miscommunication between healthcare workers and the public can result in vaccine hesitancy and failure to meet immunization goals (Hsieh et al., 2021).

Training and awareness programs are vital tools in mitigating such risks. When healthcare workers are adequately trained and aware of the risks associated with immunization programs, they are more likely to perform their duties correctly and minimize errors (Simsekler et al., 2019). Despite this, there is insufficient empirical data to prove the long-term effectiveness of training and awareness programs in reducing healthcare risks (Abdi, Delgoshaei, Ravaghi, Abbasi, & Heyrani, 2015). The need for better-designed training programs is therefore pressing, with healthcare institutions needing to incorporate specific

risk management training for their workforce to improve their ability to prevent and mitigate potential errors.

Immunization programs, which are crucial in preventing the spread of disease, can be severely hampered by risks stemming from both human errors and system failures. As highlighted by Kayode-Iyasere & Odiase (2019), increasing risk awareness among healthcare workers is vital for ensuring the successful delivery of vaccination campaigns. By promoting open and effective communication about risks, healthcare systems can empower their workforce to take proactive measures to prevent errors and improve public trust in vaccines. Training programs that emphasize risk awareness and management, combined with ongoing education about proper procedures, are essential for maintaining the effectiveness of immunization efforts (Rutten et al., 2021).

Moreover, healthcare systems must focus on developing resilience, not just by preventing errors but also by enabling healthcare workers to respond effectively when incidents occur. In the context of immunization programs, resilience can be fostered through risk awareness and preparedness, enabling workers to implement corrective actions when vaccines are not administered correctly or when public trust is undermined due to errors (Zeng & Skibniewski, 2013). A culture of resilience, reinforced by risk management, can significantly enhance the overall effectiveness of immunization efforts, particularly in regions where resources are limited, and healthcare infrastructure is fragile.

The significance of this study lies in its potential to address gaps in knowledge related to risk management and its impact on healthcare outcomes, particularly immunization programs. The research aims to explore the relationship between risk awareness, risk management, and the success of immunization programs, providing statistical evidence that can guide healthcare policymakers and professionals in improving the effectiveness of vaccination campaigns in regions like Pakistan (Hoseininezhad et al., 2021). Understanding these relationships will offer valuable insights for enhancing healthcare systems' ability to navigate complex risks and improve the overall success of immunization programs.

In conclusion, healthcare risk management is a dynamic field that continues to evolve in response to the challenges posed by technological advancements, regulatory changes, and the increasing complexity of healthcare systems. Risk awareness is a foundational component of effective risk management, and the success of immunization programs depends heavily on the ability of healthcare workers to identify, evaluate, and mitigate risks. With proper training and education, healthcare workers can significantly reduce the incidence of errors, thereby improving the success of immunization efforts and protecting public health. As healthcare systems face increasing pressure to deliver high-quality care, understanding and addressing the impact of risk awareness on healthcare outcomes is more important than ever.

## **METHODOLOGY**

The research methodology for this study is designed with the goal of providing a detailed and systematic examination of the factors that influence the success of immunization programs. Specifically, it focuses on the role of risk awareness, risk management, and the effectiveness of training programs in achieving the desired outcomes. The methodology is crafted to ensure that the findings are both valid and reliable, utilizing well-established procedures and scientific methods. The study is causal and cross-sectional in nature, aiming to investigate the relationships between key variables in the real-world context of healthcare workers in District Karak, who are involved in the expanded immunization program.

## **Study Design and Structure**

This research adopts a field study approach, where healthcare workers were directly contacted in their natural work environment. This setting ensures that the data collected reflects the true dynamics and experiences of the respondents as they perform their duties in the field. The study is designed to be as non-intrusive as possible, and a self-administered questionnaire was employed for data collection. The use of Google Forms for the survey was specifically chosen for its simplicity, accessibility, and efficiency in reaching the target population. It also minimized researcher interference, allowing respondents the flexibility to complete the questionnaire at their convenience. This approach not only reduces

potential bias but also ensures a higher level of response accuracy by providing healthcare workers with the time to reflect on their answers and respond thoughtfully. The sample size for this study was set at 338 healthcare workers from District Karak, chosen using convenience sampling. This technique was selected due to time constraints and the practical challenge of contacting healthcare workers who are actively engaged in immunization programs. Convenience sampling allows for the collection of data from a readily available group of participants while ensuring that the sample remains sufficiently representative of the target population. The respondents were selected from healthcare facilities across District Karak, including both public and private institutions, which offer a broad spectrum of experiences relevant to the study's objectives.

#### Key Variables and Measurement Tools

The research involves four key variables: risk awareness, risk management, the effectiveness of training programs, and the success of the immunization program. Each of these variables is measured using validated scales to ensure the credibility and reliability of the data collected.

**Risk Awareness:** This variable is measured using a 5-item scale developed by Scolobig et al. (2012). The items in this scale assess the respondents' awareness of risks in their work environment, specifically related to sudden events and potential hazards that could affect the success of immunization efforts. Sample items include, "Sudden events are a danger for your project" and "Sudden events are a danger for your organization." This scale provides a clear understanding of the healthcare workers' ability to recognize and respond to risks.

**Risk Management:** Risk management is assessed using a 5-item scale developed by Oehmen et al. (2014). This scale evaluates the healthcare workers' perceptions of the effectiveness of risk management practices within their organizations. One example item from this scale is, "Our employees are motivated to perform/implement risk management." This measure provides insights into the level of commitment to risk management among the

healthcare staff, which is crucial for the success of immunization programs.

**Effectiveness of Training Programs:** The effectiveness of training programs is assessed by comparing pre- and post-training scores. This scale was developed specifically for this research based on an extensive review of the literature. It aims to gauge how well training programs improve healthcare workers' understanding of risk management and their ability to implement it effectively in the context of immunization. The comparison of scores before and after the training helps measure its impact on the workers' preparedness.

**Success of Immunization Program:** To assess the success of the immunization program, a 6-item scale developed by Robey et al. (1989) was used. The items in this scale examine various aspects of the immunization program, including team performance and effectiveness in interacting with external stakeholders. A sample item from this scale is, "The amount of work the team produced" and "The effectiveness of the team's interactions with people outside the team." This helps evaluate the overall success of the immunization program from the perspective of the healthcare workers involved in its execution.

#### Data Collection and Ethical Considerations

The data collection process was guided by ethical considerations to ensure that participants were treated with respect and their rights were protected throughout the research. Before collecting data, written permission was obtained from the research graduate office at Riphah University, Islamabad, which oversees the ethical conduct of research. The research team was also required to defend the research topic and methodology in front of a research committee, which further ensured the validity of the study. All participants were provided with full details about the study's purpose and were assured of the confidentiality of their responses. Informed consent was obtained from all respondents, who were given the option to participate voluntarily. The respondents were encouraged to express their views honestly and were assured that their participation would not influence their professional standing or the

immunization program in any way. Furthermore, the data collection process was designed to minimize the potential for researcher interference. Since self-administered questionnaires were used, the researchers did not have direct contact with the respondents during the completion of the survey, reducing the likelihood of bias.

#### Data Analysis and Statistical Techniques

The collected data was analysed using SPSS software, version 22, which is widely used for statistical analysis in social sciences. Several statistical techniques were applied to analyse the data, including frequency distribution, descriptive statistics, reliability analysis, and normality tests. The reliability of the measurement scales was assessed using Cronbach's alpha to ensure that the scales were consistently measuring the intended variables.

To test the hypotheses and examine the relationships between risk awareness, risk management, training effectiveness, and the success of the immunization program, multiple regression analysis was conducted. This method allowed the researchers to assess the direct effects of risk awareness and management on the success of the immunization program, as well as the moderating effect of training effectiveness. Additionally, mediation and moderation analyses were performed using Andrew Hayes' PROCESS macro, which provides a robust framework for examining complex relationships between variables.

#### Result

The study presents a comprehensive analysis of various factors influencing the success of immunization programs, focusing on risk awareness, risk management, the effectiveness of training programs, and their relationships. The demographic analysis of the sample, consisting of 338 healthcare

workers from District Karak, reveals a predominance of males (82.2%), with a substantial portion aged 31-40 years (50.3%) and possessing post-graduate education (45.9%). The study shows high levels of risk awareness, with a mean of 3.87, indicating strong recognition of risks among healthcare workers. Reliability analysis of the latent variables reveals high Cronbach's alpha values for all variables, ranging from 0.918 for risk management to 0.955 for the effectiveness of training programs, demonstrating excellent internal consistency. Descriptive statistical analysis further confirms that healthcare workers are generally aware of the risks involved in immunization and are committed to managing them effectively. The success of the immunization program, with a mean score of 3.70, reflects a positive perception of the program's success among healthcare workers. The correlation analysis shows significant positive relationships between risk awareness, risk management, training effectiveness, and immunization success, with coefficients ranging from 0.720 to 0.791. Hypothesis testing using multiple regression analysis confirms that risk awareness positively influences both the success of the immunization program and risk management, with significant effects at the 0.01 level. Mediation analysis indicates that risk management mediates the relationship between risk awareness and immunization success, while moderation analysis reveals that the effectiveness of training programs enhances the impact of risk awareness on risk management. This comprehensive analysis highlights the critical role of risk awareness, management, and training in ensuring the success of immunization programs, offering valuable insights for improving public health strategies.

**Table 4.1: Demographic Characteristic Analysis of Study Population**

| Variable      | Frequency | Percent |
|---------------|-----------|---------|
| Gender        |           |         |
| Female        | 60        | 17.8    |
| Male          | 278       | 82.2    |
| Age           |           |         |
| 20 - 30 Years | 109       | 32.2    |
| 31 - 40 Years | 170       | 50.3    |
| 41 - 50 Years | 38        | 11.2    |
| 50 - 60 Years | 21        | 6.2     |

|                        |     |      |
|------------------------|-----|------|
| Education              |     |      |
| Graduation             | 140 | 41.4 |
| Intermediate (diploma) | 43  | 12.7 |
| Post-graduation        | 155 | 45.9 |
| Marital Status         |     |      |
| Married                | 276 | 81.7 |
| Single                 | 60  | 17.8 |
| Widow                  | 2   | 0.6  |
| Experience             |     |      |
| 11 to 15 Years         | 48  | 14.2 |
| 16 to 20 Years         | 13  | 3.8  |
| 6 to 10 Years          | 167 | 49.4 |
| Less than 5 Years      | 88  | 26.0 |
| More than 21 Years     | 22  | 6.5  |

**Table 4.2: Reliability Analysis of Latent Variables**

| Variables                         | Cronbach's Alpha | N of Items |
|-----------------------------------|------------------|------------|
| Risk Awareness                    | 0.925            | 8          |
| Risk Management                   | 0.918            | 9          |
| Effectiveness of Training Program | 0.955            | 5          |
| Success of Immunization Program   | 0.937            | 7          |

**Table 4.3: Descriptive Statistical Analysis of Risk Awareness**

| Measuring Scale Items | N   | Minimum | Maximum | Mean   | Std. Deviation |
|-----------------------|-----|---------|---------|--------|----------------|
| RA_1                  | 338 | 1       | 5       | 3.583  | 1.2916         |
| RA_2                  | 338 | 1       | 5       | 4.006  | 1.1530         |
| RA_3                  | 338 | 1       | 5       | 4.006  | 1.1452         |
| RA_4                  | 338 | 1       | 5       | 3.947  | 1.1257         |
| RA_5                  | 338 | 1       | 5       | 3.612  | 1.3976         |
| RA_6                  | 338 | 1       | 5       | 3.917  | 1.1679         |
| RA_7                  | 338 | 1       | 5       | 3.828  | 1.2009         |
| RA_8                  | 338 | 1       | 5       | 4.041  | 1.1701         |
| Risk Awareness        | 338 | 1       | 5       | 3.8676 | 0.97955        |

**Table 4.4: Descriptive Statistics of Risk Management**

| Measuring Scale Items | N   | Minimum | Maximum | Mean | Std. Deviation |
|-----------------------|-----|---------|---------|------|----------------|
| RM_1                  | 338 | 1       | 5       | 3.61 | 1.221          |
| RM_2                  | 338 | 1       | 5       | 3.43 | 1.224          |
| RM_3                  | 338 | 1       | 5       | 3.41 | 1.124          |
| RM_4                  | 338 | 1       | 5       | 3.54 | 1.127          |
| RM_5                  | 338 | 1       | 5       | 3.54 | 1.065          |
| RM_6                  | 338 | 1       | 5       | 3.52 | 1.087          |
| RM_7                  | 338 | 1       | 5       | 3.65 | 1.184          |
| RM_8                  | 338 | 1       | 5       | 3.61 | 1.189          |
| RM_9                  | 338 | 1       | 5       | 3.65 | 1.157          |
| Risk Management       | 338 | 1       | 5       | 3.55 | 0.896          |

**Table 4.5: Descriptive Statistical Analysis of Effectiveness of Training Program**

| Measuring Scale Items             | N   | Minimum | Maximum | Mean | Std. Deviation |
|-----------------------------------|-----|---------|---------|------|----------------|
| ETP_1                             | 338 | 1       | 5       | 3.93 | 1.187          |
| ETP_2                             | 338 | 1       | 5       | 3.93 | 1.177          |
| ETP_3                             | 338 | 1       | 5       | 3.89 | 1.130          |
| ETP_4                             | 338 | 1       | 5       | 4.01 | 1.122          |
| ETP_5                             | 338 | 1       | 5       | 4.17 | 1.123          |
| Effectiveness of Training Program | 338 | 1       | 5       | 3.99 | 1.057          |

**Table 4.6: Descriptive Statistical Analysis of Success of Immunization Program**

| Measuring Scale Items           | N   | Minimum | Maximum | Mean | Std. Deviation |
|---------------------------------|-----|---------|---------|------|----------------|
| SIP_1                           | 338 | 1       | 5       | 3.64 | 1.118          |
| SIP_2                           | 338 | 1       | 5       | 3.67 | 1.091          |
| SIP_3                           | 338 | 1       | 5       | 3.78 | 1.077          |
| SIP_4                           | 338 | 1       | 5       | 3.72 | 1.124          |
| SIP_5                           | 338 | 1       | 5       | 3.75 | 1.089          |
| SIP_6                           | 338 | 1       | 5       | 3.67 | 1.098          |
| SIP_7                           | 338 | 1       | 5       | 3.69 | 1.127          |
| Success of Immunization Program | 338 | 1       | 5       | 3.70 | 0.940          |

**Table 4.7: Comparative Analysis of Descriptive Statistics of Variables**

| Variable                          | N   | Minimum | Maximum | Mean | Std. Deviation |
|-----------------------------------|-----|---------|---------|------|----------------|
| Risk Awareness                    | 338 | 1       | 5       | 3.87 | 0.980          |
| Risk Management                   | 338 | 1       | 5       | 3.55 | 0.896          |
| Effectiveness of Training Program | 338 | 1       | 5       | 3.99 | 1.057          |
| Success of Immunization Program   | 338 | 1       | 5       | 3.70 | 0.940          |

**Table 4.8: Normality Analysis**

| Variable                          | Before Transformation             | After Transformation              |
|-----------------------------------|-----------------------------------|-----------------------------------|
| Risk Awareness                    | Skewness: -1.392, Kurtosis: 1.678 | Skewness: -2.853, Kurtosis: 3.277 |
| Risk Management                   | Skewness: -0.832, Kurtosis: 0.841 | Skewness: -3.379, Kurtosis: 2.357 |
| Effectiveness of Training Program | Skewness: -1.466, Kurtosis: 1.732 | Skewness: 2.918, Kurtosis: 3.338  |
| Success of Immunization Program   | Skewness: -0.999, Kurtosis: 1.085 | Skewness: -2.558, Kurtosis: 2.843 |

**Table 4.9: Correlation Analysis of Core Variables**

| Variables                            | 1       | 2       | 3       | 4 |
|--------------------------------------|---------|---------|---------|---|
| 1. Risk Awareness                    | 1       |         |         |   |
| 2. Risk Management                   | 0.747** | 1       |         |   |
| 3. Effectiveness of Training Program | 0.751** | 0.742** | 1       |   |
| 4. Success of Immunization Program   | 0.720** | 0.780** | 0.791** | 1 |

Note: Correlation is significant at the 0.01 level (2-tailed).

**Table 4.10: Hypothesis Testing through Multiple Regression Analysis**

| Variables                                                    | $\beta$ | $\Delta R^2$ | P      | CI-LL  | CI-UL  |
|--------------------------------------------------------------|---------|--------------|--------|--------|--------|
| Risk Awareness $\rightarrow$ Success of Immunization Program | 0.2965  | 0.6513       | 0.000  | 0.2049 | 0.3881 |
| Risk Awareness $\rightarrow$ Risk Management                 | 0.6837  | 0.5585       | 0.0000 | 0.6185 | 0.7489 |

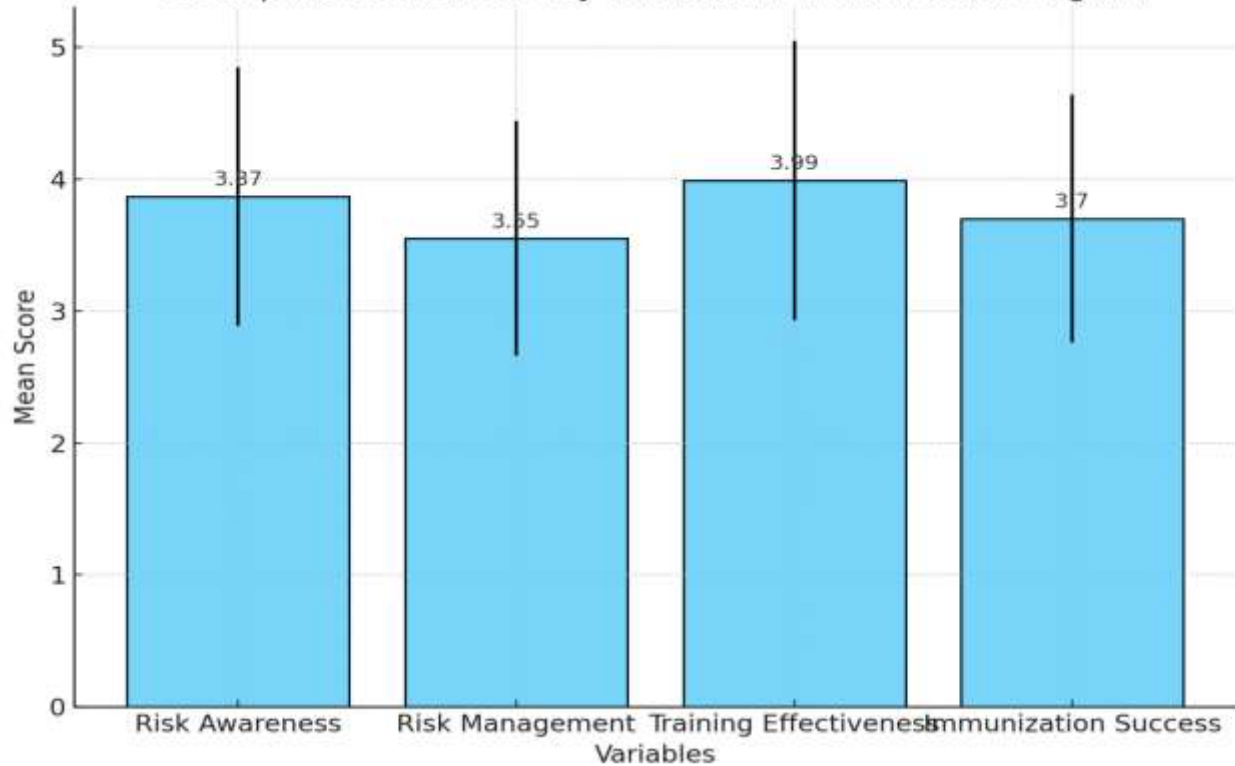
**Table 4.11: Mediation Analysis of Risk Management between Risk Awareness and Success of Immunization Program**

| Effect of IV on MV<br>(Path a) | Effect of MV on<br>DV (Path b) | Direct Effect of IV on<br>DV (Path C') | Total Effect of IV on<br>DV (Path C) | Bootstrapping for Indirect        |
|--------------------------------|--------------------------------|----------------------------------------|--------------------------------------|-----------------------------------|
| Risk Management                | 0.6837**                       | 0.5762**                               | 0.2965**                             | LL95CI: 0.2049,<br>UL95CI: 0.3881 |

**Table 4.12: Moderation Analysis of Effectiveness of Training Program between Risk Awareness and Risk Management**

| Variables                                          | $\beta$ | SE     | T      | P      | CI-LL  | CI-UL  |
|----------------------------------------------------|---------|--------|--------|--------|--------|--------|
| Risk Awareness                                     | 0.5209  | 0.0893 | 5.8295 | 0.0000 | 0.3450 | 0.6964 |
| Effectiveness of Training Program                  | 0.4566  | 0.0780 | 5.8503 | 0.0000 | 0.3031 | 0.6101 |
| Risk Awareness * Effectiveness of Training Program | 0.6552  | 0.0221 | 2.5969 | 0.0010 | 0.0786 | 0.0062 |

**Descriptive Statistics of Key Variables in Immunization Program**



## Discussion

Health is a primary concern for global actors, including states and non-governmental organizations, and is seen as a collective threat to populations worldwide. To address this, the United Nations has set goals under the Sustainable Development Goals (SDGs) 2030, aiming to eradicate communicable

diseases, including viral ones, through immunization programs. The World Health Organization (WHO) has identified a list of diseases targeted by the Expanded Program on Immunization (EPI), such as tetanus, polio, measles, hepatitis, tuberculosis, and COVID-19, emphasizing the need for universal vaccination to eradicate these diseases globally

(Bjegovic-Mikanovic, Broniatowski, Byepu, & Laaser, 2018).

However, literature reports that significant risks are associated with immunization programs, primarily driven by cultural and religious beliefs, conspiracy theories, and misinformation about vaccines. These factors contribute to vaccine hesitancy and partially hinder the success of immunization efforts. Previous studies suggest that risk awareness, risk management, and effective training programs can significantly impact the success of immunization programs, highlighting the need to explore these factors further (Nguyen et al., 2021).

This research aims to analyze the impact of risk awareness and risk management on the success of immunization programs, moderated by the effectiveness of training sessions. The study was conducted with healthcare professionals involved in the EPI in District Karak, with 338 respondents. Demographically, 82.2% of participants were male, and 50.3% were aged 31-40. The majority held postgraduate degrees (45.9%) and had 6-10 years of experience (49.4%). The findings indicate a high level of awareness among healthcare professionals regarding risks associated with immunization programs.

Reliability analysis of the questionnaire, adapted from previous studies, showed high Cronbach's alpha values for the key variables: risk awareness (0.925), risk management (0.918), effectiveness of training (0.955), and success of the immunization program (0.937), ensuring the consistency and reliability of the measures used (Milcarz, Polanska, Bak-Romaniszyn, Kaleta, & Health, 2018; Schwensen, White, Thyssen, Menné, & Johansen, 2015).

Descriptive statistical analysis revealed that risk awareness (mean  $\pm$  SD: 3.87  $\pm$  0.98) and risk management (mean  $\pm$  SD: 3.55  $\pm$  0.896) were both perceived positively by healthcare workers, with a slightly higher mean for the effectiveness of training programs (mean  $\pm$  SD: 3.99  $\pm$  1.057). The success of the immunization program was also positively rated (mean  $\pm$  SD: 3.70  $\pm$  0.940), indicating a strong perception of its success despite existing barriers.

The study's hypotheses were tested through multiple regression analysis. The first hypothesis, stating that risk awareness positively impacts the success of the immunization program, was supported with a path

coefficient of 0.2965 (p-value 0.000). The second hypothesis, asserting that risk awareness is positively associated with risk management, was also accepted with a path coefficient of 0.6837 (p-value 0.000). The third hypothesis, that risk management positively impacts immunization program success, was confirmed with a path coefficient of 0.5762 (p-value 0.000). These findings underscore that higher risk awareness leads to better risk management and, in turn, improves immunization program success (Ahmed, Scholz, Al-Faraj, Niaz, & Health, 2016).

Mediation analysis revealed that risk management significantly mediates the relationship between risk awareness and immunization program success, with a total effect path coefficient of 0.6904 (p-value < 0.001). The moderation analysis showed that the effectiveness of training programs significantly strengthens the relationship between risk awareness and risk management, with a path coefficient increase from 0.5209 to 0.6552 (p-value 0.001).

In conclusion, this study demonstrates that risk awareness and risk management are crucial for the success of immunization programs. Healthcare workers who are more aware of the risks associated with immunization are better equipped to manage these risks, thereby enhancing the effectiveness of immunization efforts. Furthermore, effective training programs play a significant role in amplifying the impact of risk awareness on risk management. These findings suggest that strengthening risk awareness and management, alongside enhancing training programs, could lead to more successful immunization campaigns, particularly in regions like District Karak (Abdel Wahed, Hefzy, Ahmed, & Hamed, 2020).

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