Journal of Service Science and Management, 2025, 18(2), 106-124
https://www.scirp.org/journal/jssm
ISSN Online: 1940-9907
ISSN Print: 1940-9893

Exploring High Reliability Organizations in the Gulf Country Region: A Cross-Sectional Study

Abdullah Saeed[1], Shaik Mohiuddin[2], Maya El-Mallat[3], Abdullah Alshafea[1]

[1]Research Unit, Ministry of Health, Abha, Saudi Arabia
[2]AL Dhafra Hospitals, SEHA, Abu Dhabi, UAE
[3]SEHA, Abu Dhabi, UAE
Email: abdallah.bds1@gmail.com, shaikm@seha.ae, mmallat@seha.ae, Dr.abdullah.128@gmail.com

How to cite this paper: Saeed, A., Mohiuddin, S., El-Mallat, M., & Alshafea, A. (2025). Exploring High Reliability Organizations in the Gulf Country Region: A Cross-Sectional Study. *Journal of Service Science and Management, 18,* 106-124.
https://doi.org/10.4236/jssm.2025.182008

Received: February 4, 2025
Accepted: March 28, 2025
Published: March 31, 2025

Abstract

Introduction: This study investigates High Reliability Organizations (HROs) in the Gulf Country Region, focusing on the Healthcare sectors. HROs are known for their ability to minimize accidents despite operating in hazardous environments. Given the rapid demand growth of the healthcare in the region, the adoption of HRO principles is crucial to ensure operational safety and reliability. **Methods:** A cross-sectional study design was employed to examine the knowledge and the implementation of HRO principles across various organizations in the two Gulf countries (i.e., Kingdom of Saudi Arabia and United Arab Emirates). Data were collected through surveys among 533 healthcare staff with key stakeholders, including leadership and operational staff. The study focused on assessing safety culture, leadership support, and familiarity with HRO principles. **Results:** The findings reveal varying levels of HRO familiarity and application across the region. Organizations in the United Arab Emirates exhibited stronger adherence to HRO practices compared to others. However, gaps were identified in continuous training and leadership commitment. Respondents highlighted the importance of promoting a proactive safety culture and enhancing organizational resilience to handle unexpected risks effectively. **Conclusion:** The study highlights the gaps in knowledge and underscores the significance of adopting HRO principles to improve safety outcomes in high-risk industries. It recommends targeted training, leadership development, and policy interventions to strengthen safety culture and high reliability principles. The research offers valuable insights for policymakers and industry leaders in the Gulf Country Region to promote high reliability in their operations.

Keywords

High Reliability Organizations, Healthcare, Gulf Country Region, Safety Culture, Leadership

1. Introduction

High Reliability Organizations (HROs) operate under challenging conditions despite complex systems, high-hazard operations, and risky technologies. Reliability in daily operations of HROs reduces severe accidents and unexpected outcomes by using a combination of high-risk policies in a highly reliable and secure environment. Five characteristics of HROs have been outlined to maintain high levels of safety despite risky work environments. These include: sensitivity to operations, reluctance to simplify, preoccupation with failure, deference to expertise, and resilience (Dwyer et al., 2023). Furthermore, HROs in various sectors follow practices generally known as procedures and data sharing, safety training, standardization, learning from incidents, redundancies, information sharing platforms, and satellite navigations. High risk and high reward importance of the healthcare sectors possess the heavy cost of errors, which is high risk. Healthcare companies' performance and global demand are expected to continue to grow, causing substantial increases. HRO principles and practices in the sector play a crucial role in ensuring them.

1.1. Background of High Reliability Organizations (HROs)

High risk industries, such as commercial aviation, offer the benefits of excellent safety and performance records by operating for millions of transactions. These organizations are considered High Reliability Organizations (HROs) (Christianson et al., 2011). HRO principles focus on safety and quality considering attempts to achieve these goals. Handling complex and risky environments, HROs need to be resilient. Resilience is the ability to overcome failures quickly and "bounce back" to normal business at the earliest, while learning from the event. High reliable industries started to process safety principles, paying attention to turning risky data into corrective data and integrating system perspectives for increased occupational periods (Serou et al., 2021). Although seriously critical and questionable events may transform in unreadable events, near accidents chaos chaotic landscapes disclosed uncertainties related to mixtures within credible components and constantly generate uncertainties. Efforts to adapt it familiar and rational took place in mechanisms like accidents synopses by concerns events influencing patient reliability and other industries suffered Principles of Safety Management. The principles of resilience engineering are similarly beneficial for understanding accidents in healthcare.

1.2. Significance of Studying HROs in the Gulf Country Region

The Gulf Country Region is known for its unique cultural heritage and geographic regions, including the United Arab Emirates, Oman, Kuwait, Qatar, Saudi Arabia, Bahrain, Iraq, Jordan, Libya and Yemen. During the past half century, regional countries achieved unprecedented economic growth, the rapid development of infrastructure facilitated international investment, and the industrial diversification reduced their dependency on traditional natural resources. Consequently, the

standard of living and the wellness of the inhabitants significantly improved. However, these advancements led to stress on the infrastructure of regional countries, threatening operational systems. The robustness of organizational practices is paramount to sustain such operational systems, necessitating High Reliability Organizations (HROs) (Karalis & Barbery, 2018).

HROs are organizations that operate in risky environments, yet have a lower rate of accidents than would be expected. These organizations avert from serious accidents even with extremely hazardous operations for periods extending over decades. The traditional view suggests that the very low rate of accidents is achieved because HROs are able to reduce the hazard in their operations as much as possible. The old, conservative machinery is replaced by modern and smart industrial technology. Labor-intensive or manual operations are transformed into automated ones. Hazardous commodities or materials are reduced or avoided completely. However, sometimes two identical plants based on mature and well-developed technology have significantly different safety records. The relatively high rate of the accidents does not necessarily result only from substandard design, construction, operation and maintenance. Equally good performances could be based on sound equipment and excellent personnel. Therefore, the root causes of jointly occurring accidents in these circumstances can be found at the wider, organizational level. Thus, HROs are those that pursue, but rarely achieve, ultra-safe operations. Because regional countries are in a continuous development process, and because the public welfare and regional stability infrastructure is often achieved via the operation of few, crucial systems, that are extremely vulnerable, the robustness of organizational practices that support critical systems is crucial.

1.3. Research Objectives and Questions

High Reliability Organizations (HROs) have been studied extensively in many industries around the world. This concept originates from a set of industries identified as "high-risk", such as the nuclear power and aviation industries. Given the similarities between these industries and the petroleum industry, much research seeks to apply HROs and their principles in refinery and healthcare processing plants. To date, however, no study has investigated HROs in relation to the healthcare in the Gulf Country region, and exploration of this realm is therefore an important opportunity. There are five main objectives to this research. The first is to determine the employees' perceptions of the pillars of HROs, namely preoccupation with failure, reluctance to simplify, sensitivity to operations, deference to expertise, and resilience. The second is to determine the employees' commitment to the safety culture in their respective refinery plants. Success in these objectives will be important for the third, where the reciprocals will be determined, that is, how safety culture contributes to safety outcomes. The fourth is to explore the moderators between safety culture and safety outcomes.

2. Literature Review

This literature review is designed to provide a comprehensive background for ex-

amining High Reliability Organizations (HROs) in the Gulf Country Region, informs relevant theories and summarises existing research. The literature review first builds up a conceptual framework of High Reliability Organizations, summarizing existing theories and research. Second, it outlines and discusses several critical characteristics of HROs. Third, prior studies on HROs in similar or relevant contexts are presented. Fourth, other studies that have applied various HRO approaches are reviewed. The discussion demonstrates the necessity of this examination and situates this study within contemporary organizational research on HROs. The first section builds a sound foundation for the following research design and data analysis.

High Reliability Organizations is a concept that focuses primarily on organizational operation and management approaches. It is particularly relevant to the safety, error recovery, and risk reducing aspects of organizations. HROs have been defined as organizations that engage in dangerous operations yet maintain no major accidents or incidents for long periods of time, or organizations that seldom encounter dangerous situations yet deal with them smoothly and without major problems (Karalis & Barbery, 2018). Theoretically, HROs have been studied and conceptualized in various perspectives.

A good deal of the research examines certain characteristics often found or emphasized by HROs. Specifically, adaptability, foresight, a clear and shared understanding of risks, decentralization, and a persistent preoccupation with safety are frequently mentioned characteristics. A few other studies discuss HROs through the lens of a resilient organization, that is, how a HRO can maintain or enhance its long-term state of safety and reliability in volatile and uncertain environments. From this point of view, two critical attributes, gap resilience and bridge resilience, are discussed, which respectively focus on how an organization prevents small issues from escalating into disasters and ensures that it has sufficient resources and capacities to overcome unexpected events. On the practical side, the management of HRO often concerns the development of safety attitude, safety culture, and communication strategies.

2.1. Conceptual Framework of HROs

Introduction In the operational landscape of hazardous industries, safety and reliability are paramount. Regulators, community stakeholders, investors, and operational agents exert different pressures on organizations, yet all converge on the key concern that operational integrity must be maintained. As such, the notion of high reliability is compelling to pursue. A wide variety of high-reliability organizations (HROs) are identified every day, all with distinctive characteristics yet sharing a common high-reliability ethos (Serou et al., 2021). The National Academies of Sciences, Engineering, and Medicine recently reported that the U.S. nuclear industry is suitable for the application of HRO principles due to its safety-critical demands. In light of this call for attention as well as the limited understanding of HRO characteristics in complex socio-technical systems, this article

explores the practices of organizations in an emergent hazardous industry: the Gulf Country region.

Conceptual Framework Organizations are increasingly operationally complex and are faced with dynamic challenges. High-reliability organizations remain operationally simple and cognitively receptive to weak signals. Taken together, HROs are organizations that are able to manage high complexity in high-risk environments through culturally embedded attitudes and practical advice (Ericksen & Dyer, 2004). The conceptual framework emphasizes the importance of core concepts (reliability, safety, and risk management) that define the operational HRO ethos. This understanding is structured through theoretical underpinnings that guide the practices of HROs. There is acknowledgment that HRO principles in their essentials are simple; that they do not comprise a fixed list but are a set of ideas from which organizations can develop the practices that best suit their circumstances and practices. Case studies of HROs widely recognize this adaptability as they expose practices unique to different industries. Broadly, HRO principles can be applied in any environment, and the aim of these on HROs is to provide a lens and a menu for organizations to understand and practically develop these practices. Finally, it is recognized that there are profound interplays between culture and each of the principles, as well as between each of the principles. In HRO literature, each of the principles is often presented in isolation to varying texture or depth. More detailed and nuanced perspectives on their interactions are required to understand how HRO principles in combination lead organizations to develop practices that enhance their operational integrity. By grounding the empirical work in established theoretical constructs, the framework lays the basis for the analysis of HRO practices in the Gulf Country region. The framework is structured to understand the relationships between the principles and to consider the various factors that inform their practice.

2.2. Characteristics of HROs

Industries with high-risk operations have begun to adopt operational strategies from High Reliability Organizations (HROs) from other industries as a method to reduce risks. HROs view operational problems as puzzles and focus their attention on strategies that make their organizations more able to manage the inherent complexity and uncertainty present in such operations. High Reliability Organizations are substantially different from conventional organizations. A few of their characteristics fundamentally differentiate them from everyday organizations. These characteristics include: preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience, and a dedicated effort towards reliability. High Reliability Organizations (HROs) have been observed and studied to articulate these characteristics and to gain insight into the effectiveness of these characteristics in high-risk operations (Christianson et al., 2011).

There is an expectation that HRO attributes are likely to aid organizations in

reverting observable safety incidents or hazards detected at an early stage, before they become severe or even catastrophic. HRO organizations have a common set of five attributes that support these operational behaviors. These are Awareness of normal activities and work processes. It has been shown that each of these attributes enables HRO organizations to detect operational precursors early in their development. Further benefits from these operational attributes have also supported the development of tools and activities to facilitate the above operational behaviors and enhance their effectiveness (Serou et al., 2021). In addition, there is a need to constantly learn and adapt to changing conditions. This results in a culture that is open and values accountability in order to recognize weaknesses in operational processes and correct them or develop workarounds. Finally, HRO organizations emphasize the importance of decentralized decision-making, particularly for the frontline workforce and ensure that these individuals are trained and empowered to act rapidly and appropriately to changing conditions. It has been suggested that these former types of attributes are present to a greater degree in HRO organizations. It is therefore likely that these attributes could be a foundation for the adoption of operational strategies to improve are possible across a wide range of industrial sectors, including those in the Gulf region.

2.3. Previous Studies on HROs in Similar Contexts

The term "High Reliability Organization" (HRO) has been in use since the late 1980s in the context of organizations that handle risky operations on a daily basis, yet operate accident-free for long periods (Karalis & Barbery, 2018). The principles of HROs usually encompass sensitivity to operations, commitment resilience, deference to expertise, and continuous improvements. Many studies on HROs are found in literature from healthcare 3, aviation, and nuclear power plants. All these studies are usually standpoints of workers or depend on more training. There is little in-depth study looking directly at the maintenance working practices and management decisions that take the view from the top working personnel (professionals and leads) to middle management around HRO principles. There are a small number of studies that explore HROs within the port or other domains. However, there is very minimal study developed on such organizations in gulf or close conditions (especially in the Gulf Country region). Any organization that has a critical function in unexpected and risky situations may benefit from HRO principles and adapting them in their organizations to increase the safety performance. In the recent years, HROs are gradually applied to the variety of industries, but there is not any known study according to author's knowledge that applies the HRO principles within the Gulf Country Region. This means insight is missing within how HRO principles are adapted to the Gulf Region, including in healthcare.

3. Methodology

This research investigates healthcare organizations on the High Reliability principles in the Gulf Country Region by adopting a cross-sectional study design. This

is the first study exploring HRO characteristics in the Gulf Country Region within the limits of currently available information, as well as the potential triggers for its formation and stakeholders' view on the realization of an HRO in this area. This cross-sectional design can facilitate the assessment of HRO characteristics at a single point in time across a number of organizations. Although this type of study design is advantageous in uncovering significant findings in a more efficient and time-effective manner, it also has some disadvantages. The results from a cross-sectional study can only provide a snapshot at a particular time, and it cannot explicitly demonstrate the causal relationships. Nonetheless, it is particularly effective in assessing the current state of HRO characteristics when benchmarked against high-risk industries such as health care and the energy sector. In addition, this study can assist organizations in monitoring their own characteristics and practices in comparison with high-reliability frameworks, as well as learning from other organizations' good practices.

A sample size of at least 533 subjects is recommended when conducting. The design of the survey guide aims to cover a broad spectrum of HRO characteristics. This approach is recommended to collect comprehensive insights into how HRO practices, such as leadership and safety learning, are implemented within each organization.

3.1. Study Design: Cross-Sectional Approach

The chosen design for this study is a cross-sectional approach. This design describes the characteristics of various healthcare organizations and their HRO practices in the two Gulf Country Region in a snapshot taken at a singular point in time, while other designs describe organizations' and practices' changes over time. There are no implications that one design is better than others, with a choice made to use the cross-sectional method due to the relatively low investment of time and effort needed to collect data, the ability to analyze organizational characteristics and HRO practices in multiple organizations simultaneously, and that data collection can be centralized and conducted by a team of researchers.

With a cross-sectional design, it is possible to paint a rich picture of individual organizations' HRO performance and an overall picture of HRO activities in the Gulf Country Region as a whole. To date, no evidence is available about HRO performance or HRO practices in this part of the world, creating explorative research questions around these topics. A cross-sectional design is well suited for explorative research, allowing for a wealth of diverse data from consultation activities with various organizations across differing sectors. As complex results are expected, it is also easier to disseminate findings through publication. Using the cross-sectional design aims to tap into rarely explored research areas. The cross-sectional design choice is seen as potentially providing fertile ground for generating applicable knowledge. Of course, there are limitations inherent to cross-sectional studies. The most significant of these is the inability to establish causality relationships (Checkoway et al., 2007). The cross-sectional design choice does not

aim to argue the superiority of one type of study over another. Longitudinal, ethnographic, or any other type of study can address different research questions better. Although cross-sectional studies have inherent limitations, significant insights can still be gleaned from them (Anderson et al., 2020). If carefully designed and executed, cross-sectional studies can contribute to the accumulation of knowledge in the field and guide further research.

3.2. Sampling Techniques and Sample Size

The application of the High-Reliability Organizations (HROs) concept can be anticipated in healthcare the two Gulf Country region. To assess the implementation, a study is conducted at operating organizations in the business cluster of the industrial atlas developed by the Ministry of Health (Murtiarso et al., 2018). The atlas lists dozens of organizations in 48 HRO-characterized healthcare sectors, which are represented in the regions under review.

3.3. Data Collection Methods

The first aim of the study is to make a cross-sectional design to explore High Reliability Organizations (HROs) operating within healthcare industry in the Gulf Country region, Saudi Arabia and United Arab Emirates. The second aim is to investigate the association between selected organizational attributes and HRO principles in the context of different types of industries. The overall aim of these aims is to be achieved in four primary activities including a comprehensive literature review on safety, HROs, and related industries in Saudi Arabia and the Arab Gulf States. The second activity is to design and pilot test data collection instruments including constructs of HROs, safety performances, and contextual factors of HRO operations. The third activity is to implement data collection in a set of purposively selected organizations, including a survey and structured interviews with key informants who are involved in safety and emergency operations. The final activity is to analyze both quantitative and qualitative data to investigate the key attributes and practices of HROs and explore their relationships. This study will fill the knowledge gap on accident risk reduction in industries and contribute to safety precaution measures in the region.

4. Results and Findings

The demographic and professional characteristics of respondents from health care organizations in GCC countries are given in the table below. As shown, the age groups of 35 - 44 years at 29.42% and 45 - 54 years at 25.63% provide a view of a predominantly middle-aged workforce. Also, there is almost an equal gender distribution, females being a little higher, at 51.44%. In terms of designation, the highest number comes out to be that of nurses, at 28.52%, underlining their high presence in health settings.

Regarding the experience levels, it is skewed towards the longer tenure with over 20 years at 38.99%, which reflects a mature and experienced workforce. In

this respect, the majority are from Saudi Arabia and the United Arab Emirates, representing 60.83% and 38.45%, respectively, concentrated in these two areas.

Regarding familiarity with HROs, a significant proportion of respondents reported at least moderate familiarity, indicating an awareness of the principles of HROs in their work environments. However, there is variation in engagement in training, with a notably high 28.70% never having participated; this suggests potential gaps in continuous professional development.

The data also shows perceptions of organizational effectiveness in promoting safety culture, as 53.43% find it extremely to moderately effective. Yet, there is recognition of areas needing improvement, notably in continuous training and education, and leadership commitment to high-reliability principles.

In all, the workforce demographics and responses reflect a seasoned yet variably trained workforce, concentrated in key GCC countries, with a critical view toward enhancing organizational practices for better reliability and safety outcomes (Table 1).

Table 1. Descriptive table for study variables.

Category	Subcategory	Respondents	Percentage
Age Distribution	25 - 34 years	113	20.40%
	35 - 44 years	163	29.42%
	45 - 54 years	142	25.63%
	55 and above	77	13.90%
	Under 25 years	59	10.65%
Gender Distribution	Female	285	51.44%
	Male	269	48.56%
Role in Healthcare Organization	Administrative Staff	122	22.02%
	Nurse	158	28.52%
	Physician	78	14.08%
	Support Staff	128	23.10%
	Other roles	68	12.27%
Experience in Healthcare Industry	1 - 5 years	83	14.98%
	6 - 10 years	96	17.33%
	11 - 20 years	159	28.70%
	More than 20 years	216	38.99%
Primary Work Location (GCC Countries)	Saudi Arabia	337	60.83%
	United Arab Emirates	213	38.45%
	Other GCC countries	4	0.72%
Familiarity with High-Reliability Organizations (HRO)	Extremely familiar	81	14.62%
	Very familiar	91	16.43%
	Moderately familiar	138	24.91%
	Slightly familiar	127	22.92%
	Not at all familiar	117	21.12%

Continued

Engagement in Training/Educational Activities	Monthly	84	15.16%
	Quarterly	80	14.44%
	Twice a year	103	18.59%
	Once a year	128	23.10%
	Never	159	28.70%
Perceived Effectiveness of Organizational Safety Culture Promotion	Extremely effective	113	20.40%
	Very effective	183	33.03%
	Moderately effective	117	21.12%
	Slightly effective	83	14.98%
	Not at all effective	58	10.47%
Organization's Encouragement for Continuous Learning and Innovation	Extremely well	139	25.09%
	Very well	72	13.00%
	Somewhat well	86	15.52%
	Moderately well	71	12.82%
	Neutral	49	8.84%
	Slightly well	64	11.55%
	Somewhat not well	10	1.81%
	Not at all well	58	10.47%
	Extremely not well	5	0.90%
Strength of Leadership in the Organization	Very strong	105	18.95%
	Strong	147	26.53%
	Neutral	144	25.99%
	Weak	74	13.36%
	Very weak	84	15.16%
Frequency of Organizational Conduct of Assessments or Audits	Always	135	24.37%
	Often	132	23.83%
	Sometimes	122	22.02%
	Rarely	83	14.98%
	Never	82	14.80%
Areas Believed to Need Most Improvement in the Organization	Continuous training and education	36	6.50%
	Error reporting and analysis	7	1.26%
	Leadership commitment	17	3.07%
	Resource allocation	23	4.15%
	Safety culture	18	3.25%
Barriers to High-Reliability Principles Implementation	Inadequate leadership support	9	1.62%
	Insufficient training	15	2.71%
	Lack of awareness	21	3.79%
	Limited resources	28	5.05%
	Resistance to change	18	3.25%

The chart shows that more experienced healthcare workers (e.g., "Administrative Staff" and "Ages 55 and above") and those situated in developed regions (e.g., "United Arab Emirates") tend to view their organizations' promotion of safety culture more effectively. This could be due to longer exposure and understanding of high-reliability principles in healthcare settings. Conversely, less experienced staff and younger workers might not fully appreciate these practices, leading to lower effectiveness ratings. Understanding these attitudes can guide targeted staff development and training initiatives (Figure 1).

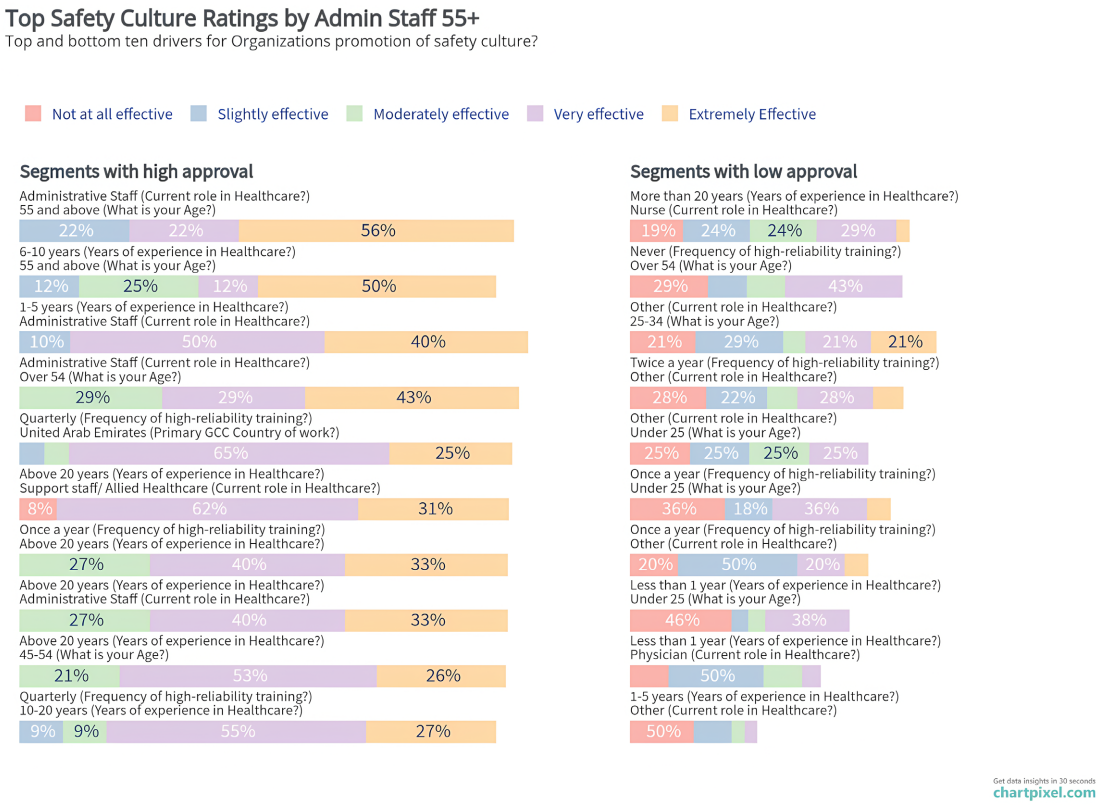

Figure 1. Safety culture effective.

The chart shows how familiar different groups of people are with the concept of High-Reliability Organizations (HRO) in healthcare. Out of 357 different groups, the highest familiarity rating (3.0) comes from people who are Under 25 years old and have a role labeled as other in healthcare. This group is Very Familiar with HRO concepts, more so than the average respondent, who is only Moderately Familiar. Breaking down the data helps, us see what factors make people more or less familiar with HRO concepts. Younger respondents (Under 25), those with more than 20 years of experience, and those in roles labeled as other tend to be more familiar. On the Other hand, Nurses, people working in the United Arab Emirates, and those with 10 - 20 years of experience tend to be less familiar. Demographics also play a role. Younger respondents and Males are generally more familiar with HRO concepts. Interestingly, while younger respondents are Very

Familiar with HRO concepts, they are less familiar with how often high-reliability compliance audits happen. The least familiar group is people Over 54 who have Never had high-reliability training, with a very low familiarity score of 0.43. Overall, respondents do not seem to have Strong opinions about their familiarity with HRO concepts (Figure 2).

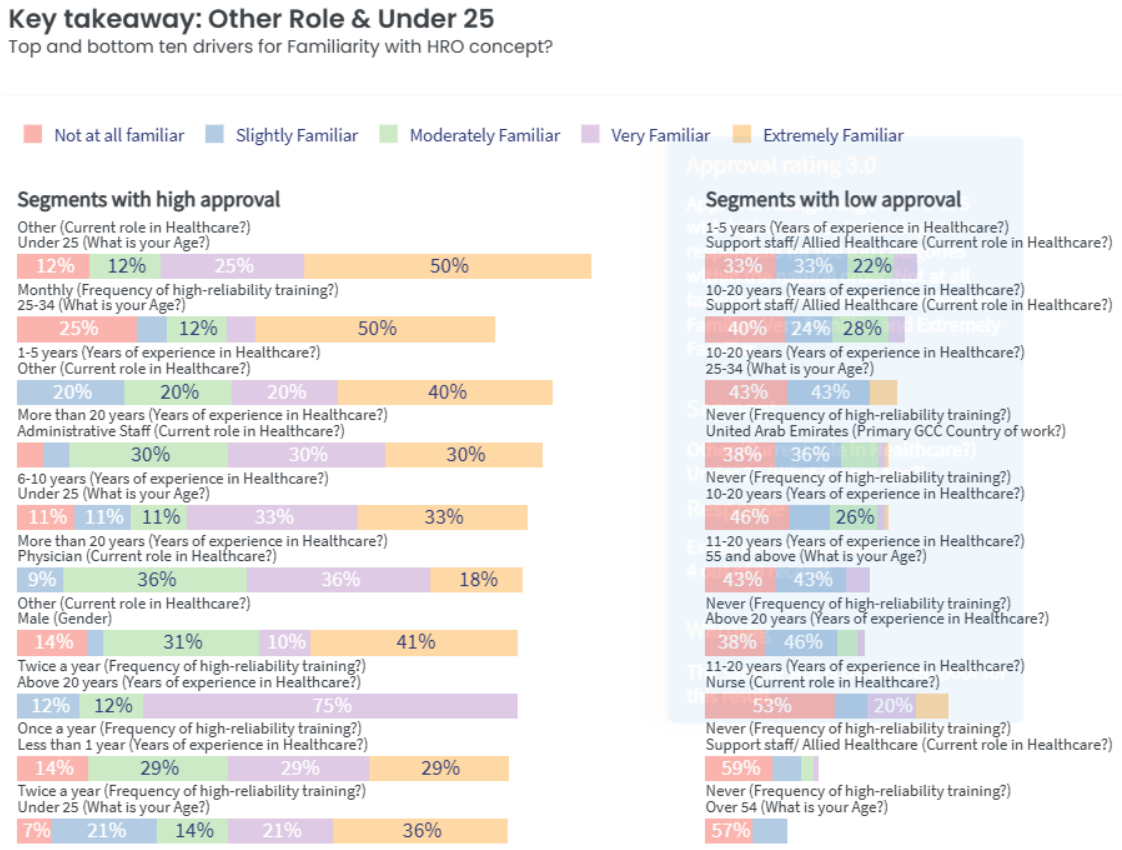

Figure 2. Familiarity with HRO concept.

The chart shows the top and bottom 10 segments for how often high-reliability compliance audits are conducted in healthcare organizations. Out of 357 segments, the highest rating (3.44) comes from respondents who have Monthly high-reliability training and work in the United Arab Emirates. The most common response is Always, which is different from the overall median response of Sometimes. Segmenting the data helps identify what influences the frequency of these audits. For example, people with over 20 years of experience in healthcare, those Over 54 years old, and those working in the United Arab Emirates tend to report higher frequencies. Conversely, those in Saudi Arabia, those who have Monthly high-reliability training, and those aged 55 and above report lower frequencies. Demographic factors like being Over 54 years old and Female also increase the reported frequency of audits. Interestingly, while those with over 20 years of experience report high frequencies for this question, they report lower familiarity with the High-Reliability Organization (HRO) concept. The lowest frequency

(1.38) is reported by those with 6-10 years of experience and those aged 55 and above. Overall, respondents seem rather indifferent and less opinionated about this question (Figure 3).

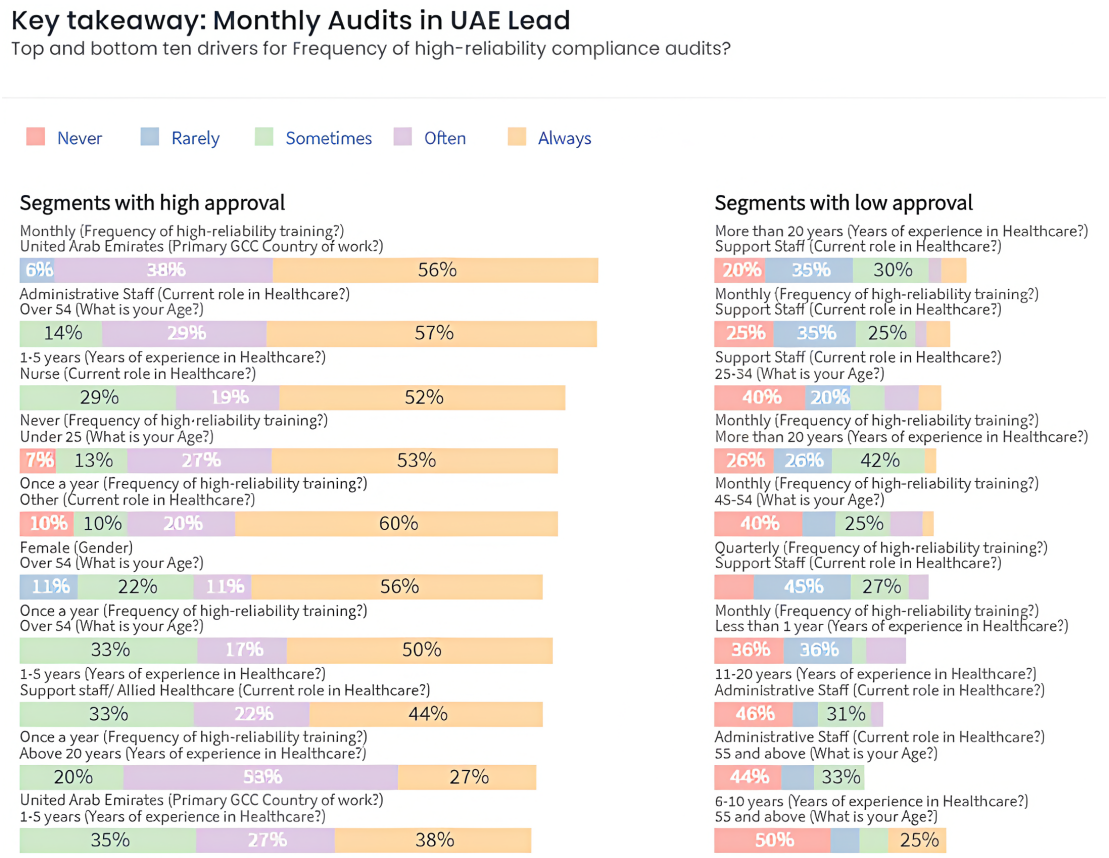

Figure 3. Monthly audits in UAE.

The chart shows the top and bottom 10 segments for how respondents rated Leadership support for high-reliability principles in healthcare organizations. Out of 357 segments, the highest rating (3.14) came from respondents who are Physicians and aged 55 and above. This group shows a very Strong median response, which is different from the overall Neutral median response in the unsegmented data. Segmenting the data helps identify what influences Strong ratings. For example, being Over 54 years old, having More than 20 years of experience in healthcare, and working in the United Arab Emirates tend to increase Strong ratings. Conversely, working in Saudi Arabia, having a different role in healthcare, and having More than 20 years of experience can decrease Strong ratings. Demographic factors like being Over 54 or aged 35 - 44 also increase Strong ratings. Interestingly, while older respondents (Over 54) show Strong support for leadership in high-reliability principles, they are less familiar with the HRO concept. The lowest rating (1.38) came from respondents who receive high-reliability training Quarterly and are Under 25 years old. Overall, respondents seem rather indifferent and less opinionated about this question (Figure 4 and Figure 5).

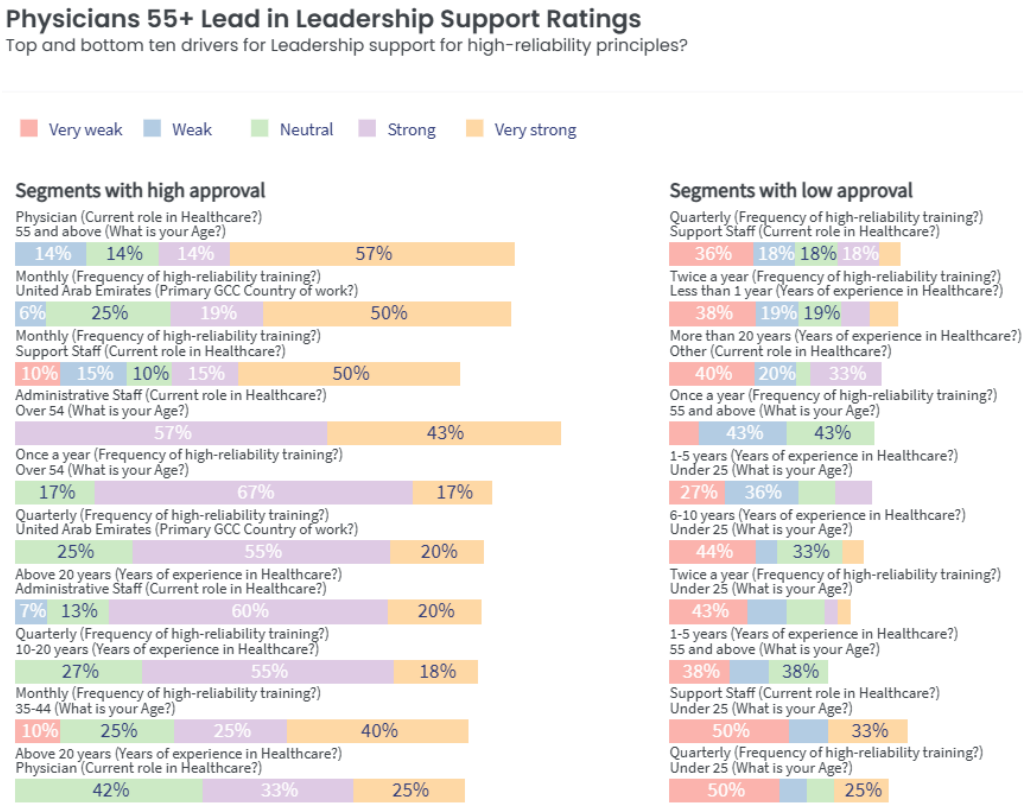

Figure 4. Physician's support for high reliability principle.

Figure 5. The qualitative analysis for comment.

This word cloud is generated from the questionnaire column Which of the following best describes your understanding of high-reliability principles in healthcare? The most frequent word is Sensitivity which appears 341 times, whereas the second most frequent word simplify interpretations appears 190 times. Click on the AI icon in the toolbar beneath the chart to dig deeper into a comment analysis. Here is the normalized word frequency list (**Table 2**).

Table 2. Word frequency list.

Term(s)	Value
Sensitivity	1.00
Simplify Interpretations	0.79
Commitment	0.76
Preoccupation	0.47
Operations	0.45
Reluctance	0.40
Deference	0.39
Failure	0.39
Simplify	0.30
Operations Commitment	0.25
Expertise	0.24
Resilience	0.23
Expertise Sensitivity	0.23
Interpretations Deference	0.22
Failure Reluctance	0.21
Resilience Preoccupation	0.21
Operations Preoccupation	0.21
Expertise Commitment	0.21
Operations Reluctance	0.20
Failure Deference	0.20
Resilience Deference	0.19
Resilience Sensitivity	0.18
Expertise Preoccupation	0.17
Resilience Reluctance	0.16

The following demographic correlations, from analysis of the survey data, provide insight into some of the attributes and perceptions of healthcare professionals about HROs:

Age and Experience: The correlation between age and years of experience is a moderate positive, 0.276. Thus, it can be said that with increased age, the years of experience in the healthcare industry also increase. Besides this, age has a weak positive correlation of 0.145 with the familiarity of HRO concepts, which may indicate that older healthcare professionals are somewhat more familiar with these principles than their younger colleagues. Gender and Work Environment: Looking at the country of main operation, GCC reports a weak positive correlation with gender: r = 0.188 and with current role in the healthcare organization, r = 0.171. The latter reflects partial variation in the roles different genders take in different countries. Professional Experience and HRO Familiarity: The experience

within the health care industry is weakly related to familiarity with HRO principles, r = 0.135. It follows that as years of experience increase, so does the familiarity with the concepts of HRO; however, it is not strongly related. Country and Role in the Organization: The relationship of respondents' roles in the health organization to the country they work in is weak, having a correlation value of 0.140, hence showing slight differences in roles based on geographic locations in the GCC. These correlations, in summary, reflect a gradient of understanding and implementation of high-reliability principles related to demographic factors such as age, gender, professional experience, and geographical location within GCC countries (Table 3).

Table 3. Presenting the correlation coefficients among demographic features from the survey data.

Demographic Features	Age Correlation	Gender Correlation	Role Correlation	Experience Correlation	Country Correlation	HRO Familiarity Correlation
What is your Age?	1.000	0.212	0.043	0.276	−0.028	0.145
Gender	0.212	1.000	0.171	0.123	0.188	0.119
Current role in the Healthcare organization	0.043	0.171	1.000	−0.009	0.140	0.099
Years of experience in Healthcare Industry	0.276	0.123	−0.009	1.000	−0.162	0.135
Gulf Cooperation Council (GCC) Countries	−0.028	0.188	0.140	−0.162	1.000	0.052
Familiarity with the concept of High-Reliability Organizations	0.145	0.119	0.099	0.135	0.052	1

5. Discussion

This study of High Reliability Organizations (HROs) in the UAE has presented the development of a new and unique instrument, based on existing research. The instrument includes a comprehensive ideal-type, developed inductively. Making use of 708 survey questionnaires the instrument is operationalized with 22 item constructs and tested with respect to their presence within the UAE and Saudi Arabia. The results of a two-step data analysis, testing the average level of reliability performance of firms first, and secondly hypotheses about the relationships between independent and dependent variables, are reported here. Prior to discussing the implications and contributions, the findings are discussed in the light of existing HRO characteristics and practices (Ericksen & Dyer, 2004).

The first theme to emerge from the data was a common statewide commitment to reliability, possibly the most significant characteristic. It was found in the research that firms in the UAE typically had a number of robust programs and processes in place that served to pursue this reliability goal.

5.1. Interpretation of Findings in Relation to Existing Literature

High Reliability Organizations (HROs) constitute an evolving yet critically underresearched paradigm in the Gulf country region. The findings of this cross-sectional study, therefore, provide a sound basis for a critical discussion in relation

to existing literature on HROs. One of the primary aims in this discussion is to consider the results of the study in relationship to established knowledge on HROs. This requires, in part, a consideration of the broader primary research that has delineated this knowledge. In doing so, similarities and variations are noted between the findings and the existing literature. It also provides an opportunity to reflect on the general efficacy of HRO characteristics as a theoretical grounding for safety in a wide variety of organizational contexts. Following this, the discussion documents the themes emerging from the study that do resonate with earlier research, and, as such, both speak to the findings and validate the study (Anderson et al., 2020). On the other hand, there are areas of apparent adaptation which result in notable divergences, not least across a number of emergent themes. In a localized consideration of HROs, therefore, this necessarily provides further insight into practices that have often been viewed with clarity, or indeed have been visible, from outside perspectives; it is a critical consideration of HRO safety as a transferable framework.

There is a growing body of literature dedicated to HROs, but mainly in the fields of sociology, healthcare, and military sciences with poor focus on the Gulf country region. In most cases, HROs apply a combination of common practices so as to manage risks more effectively in comparison with similar organizations and few efforts are made to define managerial strategies for achieving HRO status. While HRO practices appear to navigate numerous serious challenges effectively, they remain structurally complex and difficult to achieve. Benefits of achieving and retaining high reliability in uncertain, high-risk environments are manifold. Nonetheless, there are obstacles to achieving HRO status that persist within healthcare organizations (Murtiarso et al., 2018). HRO principles offer a strategic framework enabling healthcare organizations to improve safety and quality performance, yet the translation into practical policies remains challenging, necessitating a fine adaptation of HRO precepts. Major limitations include lack of consensus about the necessary lengths of time that must pass following the adoption of common practices for HRO status to be conferred.

5.2. Implications for Practice and Policy

The findings of this study have important practical implications for organizations aspiring to implement High Reliability Organization principles. This study shows that there is a clustering of HRO characteristics in the sectors other than healthcare, which sustain the HRO concept. There are practices related to internal and external focus, institutional learning, promoting trust and reducing hierarchical structures, and adaptability and flexibility in practice in the sectors other than healthcare. This finding is of use to practitioners in the resource-based sectors seeking to implement HRO principles. A set of actionable strategies derived from these practices are put forward below that practitioners can adopt and adapt in their organizations to improve reliability and safety. Additionally, the implications for policy are also considered. An argument is made for the need of regula-

tory frameworks supportive of HRO practices to be created so HROs can flourish. It is also contended that in order for such a framework to foster the development of HROs in the sectors examined, four features unique to the Gulf Country regional, but also regionally widespread, need to be considered (Hafeez-Baig et al., 2016). These features are the potential for natural disaster hazards, the distance from state decision-making centers, the transnational labor force, and influence of the commodity market volatilities.

The argument put forward is that though there are ready-to-use HRO practices already evident in existing non-HRO organizations in the sectors, practitioners of those sectors need to have in place a socio-cultural and managerial infrastructure to instate and contain these practices, especially in the context of a region such as the Gulf Country region. In particular, the policies supportive of HRO development in the sectors are highlighted such as creating socio-cultural conditions conducive to HRO sustainability and external state-central operations.

5.3. Limitations and Future Research Directions

In hindsight, several limitations are candidly acknowledged, which may have influenced the finding significantly. The key issue of the study concerns the generalizability of findings. While the organizations studied are representative of the setting in which the research was conducted, the results may not be generalizable across a wide range of industries, cultural settings, organization scales, or geographic locations. Moreover, the potential sampling bias due to the nature of the sample (i.e. organizations that choose to participate in safety reviews and are willing to respond to researchers) may affect the representativeness of findings. Observational bias in data collection is another cause of concern, even though anonymity was assured. Furthermore, the cross-sectional design of the study may limit the interpretation of causality inferences or the assessment of changes over time because time-varying variables are not controlled in the model 5. This is a general problem of cross-sectional design and the solution should be an improvement in the methodology through more sophisticated research designs.

The interpretation of findings should also consider the context of the organizations. The organizational and operational environment of the participating organizations may have influenced the adoption and implementation of HRO practices. The age of the organizations may impact its cultural setup and confound the perception of HRO implementation maturity. The pre-adaptation of major hazard-related sectors in the region could influence the HRO prevalence as they might strategically adopt it inherently. The variation of industrial sectors of the organizations could also affect the results because HRO practices generally are not uniformly implemented across all high-risk organizations. For example, the level of technology and automation could influence the implementation of preoccupation with failure as a HRO practice in different ways. High technology and complex systems industries might use automated condition monitoring systems as a tool for observing the state of equipment, thus paying less attention to physical obser-

vations. On the other hand, organizations with less advanced technologies may be pushed to cynically use only formalistic and superficial routines, which can be easily mimicked.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Anderson, J. E., Aase, K., Bal, R., Bourrier, M., Braithwaite, J., Nakajima, K. et al. (2020). Multilevel Influences on Resilient Healthcare in Six Countries: An International Comparative Study Protocol. *BMJ Open, 10*, e039158. https://doi.org/10.1136/bmjopen-2020-039158 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7722365/

Checkoway, H., Pearce, N., & Kriebel, D. (2007). Selecting Appropriate Study Designs to Address Specific Research Questions in Occupational Epidemiology. *Occupational and Environmental Medicine, 64*, 633-638. https://doi.org/10.1136/oem.2006.029967 https://core.ac.uk/download/13094532.pdf

Christianson, M. K., Sutcliffe, K. M., Miller, M. A., & Iwashyna, T. J. (2011). Becoming a High Reliability Organization. *Critical Care, 15*, 314. https://doi.org/10.1186/cc10360 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3388695/

Dwyer, J., Karanikas, N., & Sav, A. (2023). Scoping Review of Peer-Reviewed Empirical Studies on Implementing High Reliability Organisation Theory. *Safety Science, 164*, Article ID: 106178. https://doi.org/10.1016/j.ssci.2023.106178 https://www.sciencedirect.com/science/article/pii/S0925753523001200

Ericksen, J., & Dyer, L. (2004). Toward a Strategic Human Resource Management Model of High Reliability Organization Performance. *The International Journal of Human Resource Management, 16*, 907-928. https://doi.org/10.1080/09585190500120731 https://core.ac.uk/download/5119743.pdf

Hafeez-Baig, A., Gururajan, R., & Chakraborty, S. (2016). *Assuring Reliability in Qualitative Studies: A Health Informatics Perspective*. https://core.ac.uk/download/211499826.pdf

Karalis, E., & Barbery, G. (2018). The Common Barriers and Facilitators for a Healthcare Organization Becoming a High Reliability Organization. *Asia Pacific Journal of Health Management, 13*, i05. https://doi.org/10.24083/apjhm.v13i3.119 https://core.ac.uk/download/230756916.pdf

Murtiarso, I. B. H., Graha, Y. I., & Alnabawi, N. (2018). Analysis of the Role of Quality on Job Satisfaction in Management with Sampling Techniques. *Aptisi Transactions on Management (ATM), 2*, 28-36. https://doi.org/10.33050/atm.v2i1.785 https://media.neliti.com/media/publications/275172-analysis-of-the-role-of-quality-on-job-s-baa4724c.pdf

Serou, N., Sahota, L. M., Husband, A. K., Forrest, S. P., Slight, R. D., & Slight, S. P. (2021). Learning from Safety Incidents in High-Reliability Organizations: A Systematic Review of Learning Tools That Could Be Adapted and Used in Healthcare. *International Journal for Quality in Health Care, 33*, mzab046. https://doi.org/10.1093/intqhc/mzab046 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8271183/