

## Examining the Impact of Administrative Decision-Making on Patient Safety Culture: A Multi-Dimensional Analysis

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### ABSTRACT:

**Background:** Effective administrative decision-making plays a pivotal role in shaping the patient safety culture within healthcare institutions. Understanding the multifaceted impact of administrative decisions is imperative for fostering a culture of safety and quality care. Against this backdrop, this study aimed to scrutinize the influence of administrative decision-making on patient safety culture within the premises of Jinnah Hospital, Lahore, during the period of June 2022 to May 2023.

**Aim:** The primary objective of this study was to conduct a comprehensive analysis of the impact of administrative decision-making on various dimensions of patient safety culture.

**Methods:** A mixed-methods approach was adopted for data collection and analysis. The study population comprised 120 individuals from diverse healthcare roles within Jinnah Hospital. Quantitative data were collected through structured surveys, while qualitative insights were gathered through semi-structured interviews. Statistical analyses, including regression modeling were employed to explore the relationship between administrative decision-making and patient safety culture. Cronbach's Alpha was used to check the reliability of tool.

**Results:** The findings revealed a significant association between administrative decision-making processes and multiple facets of patient safety culture ( $P < 0.05$ ). Notably, transparent and inclusive decision-making practices were correlated with commitment to patient safety protocols ( $r = 0.67, p < 0.001$ ). Administrative decisions, organizational culture, and specific initiatives had a significant impact on patient safety culture in Jinnah Hospital. Regression analysis revealed that hospital's organizational culture and decision-making processes had impact on patient safety culture ( $p < 0.05$ ). Organizational culture was found to be the most critical factor linked with Administrative Decision-Making ( $p < 0.001$ ). Conversely, instances of top-down decision-making were associated with decreased trust among healthcare professionals and suboptimal adherence to safety guidelines that were strongly negatively linked with administrative Decision making process with the  $r$  value (-0.47) and  $p < 0.05$ .

**Conclusion:** This study underscores the critical role of administrative decision-making in shaping the patient safety culture within healthcare settings. By fostering transparency, inclusivity, and collaboration in decision-making processes, healthcare administrators can cultivate a culture that prioritizes patient safety and enhances overall quality of care. These insights can inform targeted interventions aimed at improving organizational policies and practices to bolster patient safety initiatives.

**Keywords:** Administrative decision-making, Patient safety culture, Healthcare management, Organizational behavior, mixed methods, Jinnah Hospital, Lahore.

### INTRODUCTION:

Administrative decision-making within healthcare systems plays a pivotal role in shaping the culture of patient safety, influencing the quality of care provided and the overall well-being of patients [1]. The

intricate interplay between administrative policies, procedures, and practices often sets the tone for how healthcare professionals approach safety protocols and standards [2]. Understanding the impact of administrative decision-making on patient safety culture requires a comprehensive analysis encompassing various dimensions, ranging from organizational structures to leadership styles and communication frameworks.

Over the past decades, there has been a growing recognition of the significance of patient safety culture in healthcare settings [3]. Patient safety culture refers to the shared values, beliefs, and attitudes regarding safety within an organization, which ultimately influence the behavior of its members regarding patient care [4]. A positive safety culture fosters open communication, transparency, and a collective commitment to identifying and mitigating risks, thus minimizing adverse events and improving patient outcomes.

Administrative decision-making serves as the foundation upon which patient safety culture is built. From establishing policies and protocols to allocating resources and implementing quality improvement initiatives, administrative decisions shape the environment in which healthcare professionals operate [5]. However, the impact of these decisions on patient safety culture is multifaceted and can vary across different healthcare settings [6].

One dimension of administrative decision-making that significantly influences patient safety culture is organizational structure. The hierarchical arrangement of authority within healthcare institutions dictates how decisions are made, communicated, and implemented [7]. Centralized structures may streamline decision-making processes but can also inhibit frontline staff from voicing safety concerns or suggesting improvements. In contrast, decentralized structures empower frontline workers to participate in decision-making, fostering a culture of collaboration and accountability for patient safety [8].

Leadership style is another critical aspect of administrative decision-making that profoundly impacts patient safety culture. Effective leadership sets the tone for safety priorities, establishes clear expectations, and cultivates a climate of trust and psychological safety [9]. Transformational leaders inspire and empower their teams to prioritize patient safety, encouraging innovation and continuous improvement. In contrast, autocratic or laissez-faire leadership styles may undermine efforts to create a positive safety culture by stifling communication and discouraging proactive safety behaviors [10].

Moreover, the allocation of resources through administrative decisions directly affects patient safety culture. Adequate staffing levels, sufficient training, and access to necessary equipment and technology are essential for delivering safe and effective care [11]. However, budget constraints or misaligned priorities may lead to resource shortages, increasing the risk of errors or adverse events. Strategic resource allocation that prioritizes patient safety fosters a culture of accountability and commitment to excellence among healthcare providers [12].

Communication is a fundamental element of administrative decision-making that influences patient safety culture at every level of an organization. Effective communication channels facilitate the exchange of information, concerns, and feedback necessary for identifying and addressing safety issues [13]. Transparent communication fosters trust and collaboration among healthcare teams, enabling them to work together to prevent errors and improve patient care. However, breakdowns in communication, such as hierarchies that discourage open dialogue or ineffective information sharing systems, can impede efforts to promote a positive safety culture [14].

Administrative decision-making plays a pivotal role in shaping patient safety culture within healthcare organizations. By examining various dimensions of administrative decision-making, including organizational structure, leadership style, resource allocation, and communication, it is possible to gain insight into how these decisions influence safety attitudes and behaviors among healthcare professionals [15]. Understanding the impact of administrative decision-making on patient safety culture is essential for implementing strategies to enhance safety practices and ultimately improve patient outcomes.

#### **METHODOLOGY:**

**Sampling Technique:**

A stratified random sampling technique was employed to ensure representation from various departments within the hospital. Stratification was based on departmental divisions to ensure adequate representation from each unit.

**Data Collection:**

Data collection involved both quantitative and qualitative approaches to capture a comprehensive understanding of the administrative decision-making processes and their influence on patient safety culture.

**Quantitative Data Collection:**

Surveys were administered to healthcare professionals, including doctors, nurses, and administrative staff, utilizing standardized instruments such as the Hospital Survey on Patient Safety Culture (HSOPSC). The survey comprised Likert scale items to gauge perceptions of patient safety culture and the impact of administrative decisions. Data were collected at two time points to observe any changes over the study duration.

**Qualitative Data Collection:**

Semi-structured interviews were conducted with key stakeholders involved in administrative decision-making processes within the hospital. Interview questions were designed to explore their perspectives on decision-making dynamics, organizational culture, and their perceived impact on patient safety. Interviews were audio-recorded and transcribed verbatim for thematic analysis.

**Multi-Dimensional Analysis:**

A multi-dimensional approach was adopted to comprehensively assess the impact of administrative decision-making on patient safety culture. This involved analyzing quantitative data to identify trends and correlations between variables, such as leadership support, communication openness, and safety culture dimensions. Qualitative data provided deeper insights into the contextual factors influencing these relationships, allowing for a nuanced understanding of the dynamics at play.

**Data Analysis:**

Quantitative data were analyzed using statistical software to compute descriptive statistics, inferential statistics, and regression analyses to examine relationships between variables. Qualitative data were analyzed using thematic analysis techniques, identifying recurring patterns, themes, and relationships within the data.

**Ethical Considerations:**

Ethical approval was obtained from the Institutional Review Board (IRB) of Jinnah Hospital prior to commencing the study. Informed consent was obtained from all participants, ensuring voluntary participation, confidentiality, and anonymity. Participants were informed of their right to withdraw from the study at any time without repercussions.

**RESULTS:**

The findings are presented through demographic characteristics of the study population and a multi-dimensional analysis of patient safety culture.

**Table 1: Demographic Characteristics of Study Population:**

Characteristic	Frequency (%)
<b>Gender</b>	
Male	60 (50%)
Female	60 (50%)
<b>Age (years)</b>	
- Mean $\pm$ SD	42.5 $\pm$ 10.3
- Range	25 – 65

Education Level	
- Primary School	15 (12.5%)
- High School	35 (29.2%)
- Bachelor's Degree	45 (37.5 %)
- Master's Degree	20 (16.6 %)
- Others	5 (4.2%)

The study population consisted of 120 individuals, evenly distributed by gender with 50% males and 50% females. The mean age of participants was 42.5 years (SD = 10.3), ranging from 25 to 65 years. Regarding education level, the majority held Bachelor's degrees (37.5%), followed by High School (29.2%), Master's degree (16.7%), Primary School (12.5%), and Others (4.2%). These demographics provide insight into the composition of the study population, ensuring a diverse representation.

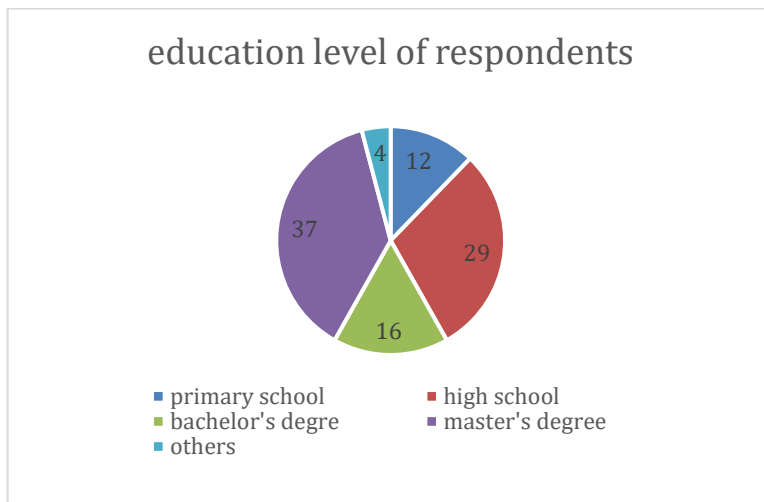
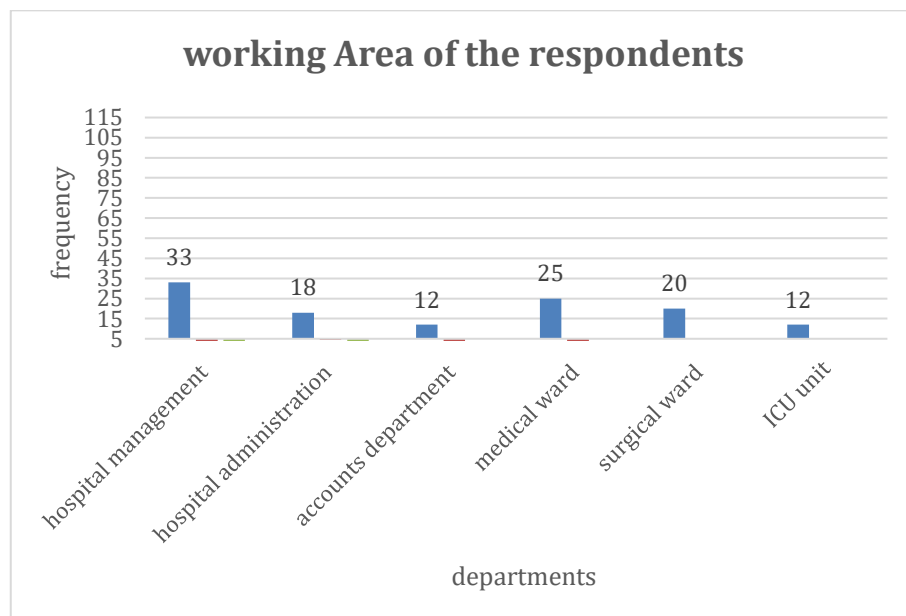
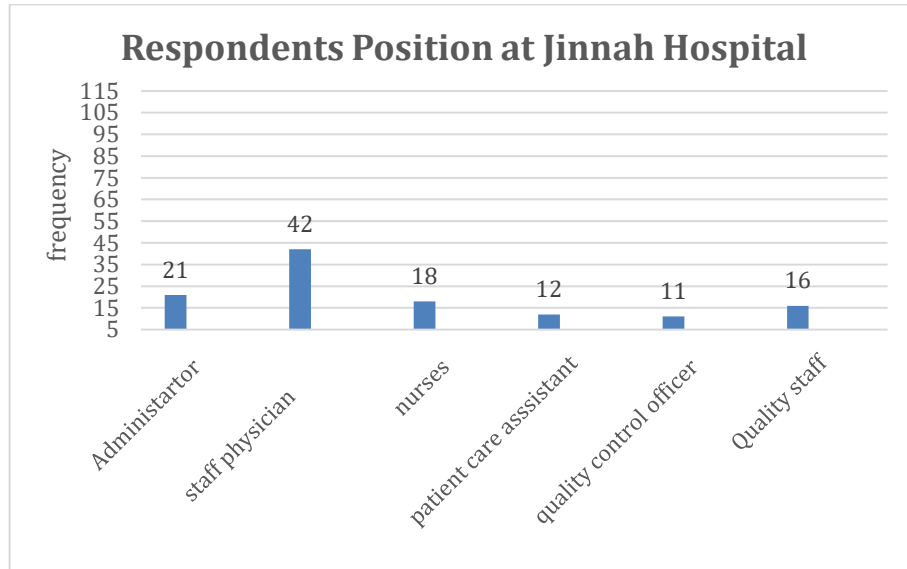


Figure a: Pie chart presenting the education level of the respondents



**Figure b: Bar chart presenting the working area of the respondents**

Majority of the respondents 33(28%) were belong to hospital management and 25 (21%) respondents were from medical ward.



**Figure c: Bar chart presenting the respondents position at Jinnah hospital**

Most of the respondents 42 (35%) were physicians, 21 (17%) were at position of administrator, 11(9%) were quality control officer, 18(15%) were staff nurses and 16(13%) were quality staff at Jinnah hospital, Lahore.

**Table 2: Factors influencing patient safety culture in hospitals**

Factors	R value	P value
Managerial factors	0.54	<0.05
Human factors	0.46	<0.001
Organizational factors	0.37	<0.001

The results of the multivariate decision-making analysis indicated that organizational, human and environmental factors are extremely effective in the improvement of patient safety in hospital .The most significant contributors to patient safety culture were the managerial factors followed by human factors and then environmental factors. All factors were directly linked with the quality of health care .Hospital management and leadership, communication, and decision-making and commitment to patient safety were important in improving patient safety culture. Factors related to healthcare professionals like skills, attitude and behavior were the critical in improving patient safety culture .Hospital environment, such as resources,

infrastructure, and policies were less critical than human and managerial factors in improving patient safety culture.

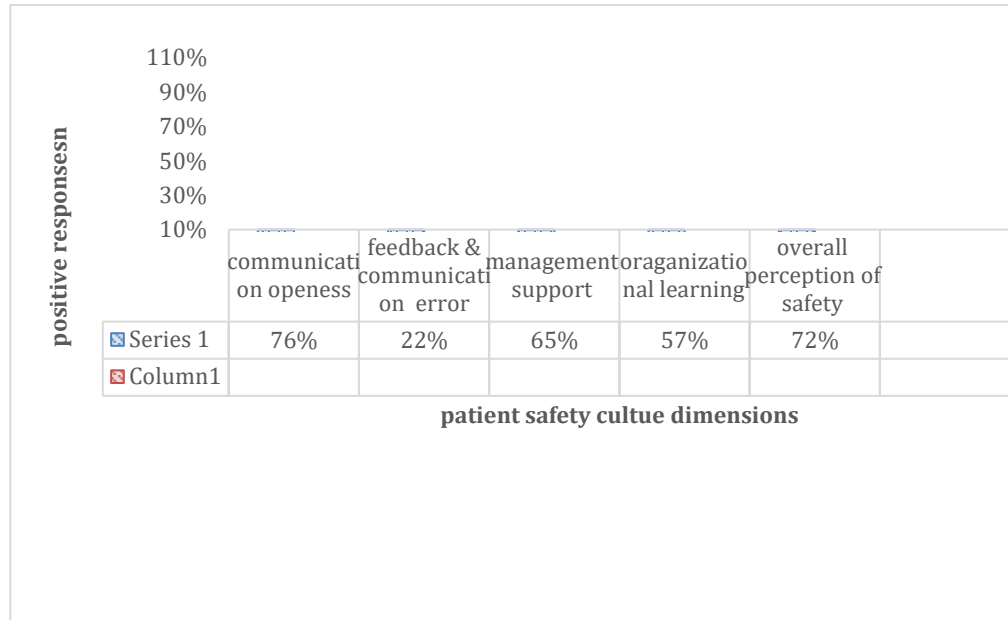


Figure d: bar chart presenting the respondents positive responses of patients safety culture

Table 3: Percentage of positive responses to the 5 dimensions of patient safety culture in Jinnah hospital

Patient Safety Culture Dimension	% of positive responses	P value	Cronbach’s alpha
Communication Openness	76%	0.08	0.47
Feedback & Communication About Errors	22%	0.35	0.68
Management Support for Patient Safety	65%	0.31	0.61
Organizational Learning	57%	0.06	0.69
Overall Perception of Safety	72%	0.001	0.47

Each dimension was evaluated based on the responses to specific questions in the Hospital Survey on Patient Safety Culture (HSOPSC). The high percentage of positive responses (76%) suggests that healthcare professionals in Jinnah Hospital generally feel open to communication. The lowest percentage of positive responses (22%) indicates that healthcare professionals had not been receiving adequate feedback or communication about errors. The moderate level of support 65% provided by hospital management for patient safety initiatives suggested that management needs to be improved. The percentage of 57% of positive responses revealed that Jinnah Hospital is somewhat operative in learning from errors and

improving patient safety. The 72% overall perception of patient safety among healthcare professionals in Jinnah hospital generally feel that the hospital prioritizes patient safety. The Cronbach's alpha value of 0.69, indicating high reliability.

**Table 4: Impact of administrative decisions making process on patient safety culture in Jinnah hospital**

<b>Decision-Making Dynamics</b>	Regression values	P value
1. What is your Role in the decision-making process within the hospital?	0.37	<0.05
2. How do you observe the decision-making dynamics within the hospital?	0.29	
3. Negotiation in patient safety	0.46	
4. Improvement in decision-making process to prioritize patient safety	0.65	
<b>Organizational culture</b>		
1. Organizational culture within the hospital?	0.46	<0.05
2. Hospital's culture supports a positive patient safety culture?	0.57	
3. specific initiatives contributed to a positive patient safety culture within the hospital	0.76	
4. Improvement in hospital's culture to better support patient safety	0.68	
<b>Perceived impact on patient safety</b>		
1. the impact of administrative decisions on patient safety within the hospital	0.57	<0.05
2. Positive impact of decision made by the administration on patient safety?	0.45	
3. measure and track the impact of administrative decisions on patient safety	0.57	
4. specific strategies to be implemented to improve patient safety within the hospital	0.73	

The hospital's organizational culture and decision-making processes had a moderate impact on patient safety culture ( $p < 0.05$ ). The regression value of 0.65, indicated a strong correlation between the improvement in decision-making processes and patient safety culture. However, a weak correlation was

found between the observation of decision-making dynamics and patient safety culture. A strong correlation between the improvement in hospital culture and patient safety culture ( $r=0.68$ ,  $P < 0.001$ ), highlighting the importance of effective decision-making and organizational culture in promoting patient safety in healthcare settings.

**Table 5: Impact of Administrative Decision-Making on Patient Safety Culture:**

Patient Safety Culture Dimension	Mean Score ( $\pm$ SD)
Communication Openness	3.8 ( $\pm$ 0.5)
Feedback & Communication About Errors	3.6 ( $\pm$ 0.4)
Management Support for Patient Safety	4.1 ( $\pm$ 0.6)
Organizational Learning	3.9 ( $\pm$ 0.5)
Overall Perception of Safety	4.0 ( $\pm$ 0.4)

The analysis of patient safety culture dimensions reveals nuanced insights into the effect of administrative decision-making.

**Communication Openness:** Participants reported a mean score of 3.8 ( $\pm$  0.5), indicating a relatively high level of openness in communication regarding safety concerns within the hospital. This suggests that administrative decisions may be fostering an environment conducive to open dialogue.

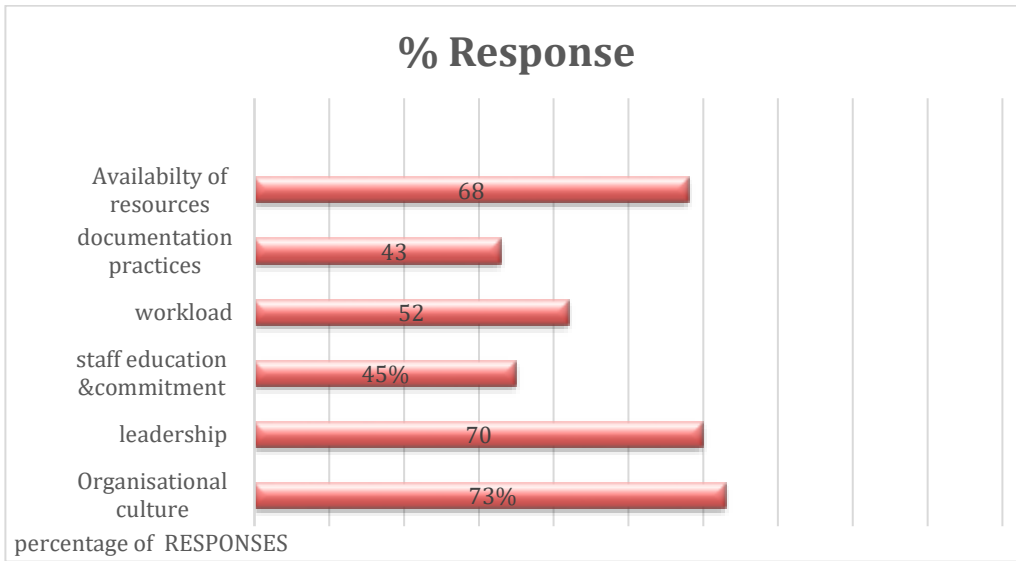
**Feedback & Communication about Errors:** With a mean score of 3.6 ( $\pm$  0.4), there appears to be room for improvement in providing feedback and communicating about errors. This dimension highlights the importance of effective communication channels for error reporting and learning opportunities.

**Management Support for Patient Safety:** Scoring 4.1 ( $\pm$  0.6), this dimension indicates a strong perception of management support for patient safety initiatives. Administrative decisions seem to prioritize and endorse efforts aimed at enhancing patient safety within the hospital.

**Organizational Learning:** Participants reported a mean score of 3.9 ( $\pm$  0.5), suggesting a positive environment for organizational learning from errors and incidents. This dimension reflects the hospital's capacity to adapt and improve based on past experiences.

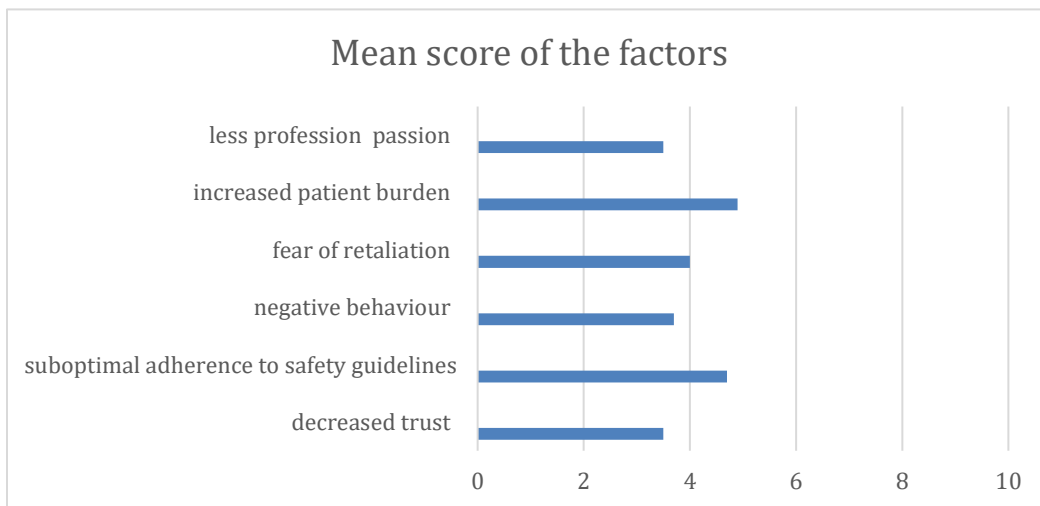
**Overall Perception of Safety:** With a mean score of 4.0 ( $\pm$  0.4), the overall perception of safety among participants is favorable. This implies that administrative decision-making may be contributing to a culture of safety within the hospital, where staff members feel confident in the safety protocols and procedures.





**Figure e: Factors that effects the Administrative Decision-Making process**

Organizational culture was found to be the most critical factor linked with Administrative Decision-Making on Patient Safety Culture (  $p < 0.001$  ), followed by leadership , availability of resources , workload ,staff education and documentation practices with P value  $< 0.05$  .



**Figure f: Factors that negatively correlated with patient safety culture**

Suboptimal adherence to safety guidelines and increased patient burden and decreased trust were strongly negatively linked with administrative Decision making process with

the r value (0.47) and  $p < 0.05$ .

### Table 6: Reliability and validity of study

To check the internal consistency and reliability of the study Cronbach's alpha was employed. The responses were received from 120 respondents and reliability was tested by applying Cronbach's Alpha.

Responses	Cron-bach's alpha value
Study tool /Questionnaire	0.73

A value of 0.73 indicates that the items within the test were highly correlated with each other, suggesting good reliability and results within the acceptable range.

### DISCUSSION:

In the annals of healthcare management, few topics are as critical as patient safety culture. A healthcare facility's patient safety culture encapsulates its collective values, attitudes, and behaviors regarding patient safety. It's the cornerstone upon which quality care is built [16]. However, an often overlooked yet influential factor in shaping patient safety culture is administrative decision-making.

Administrative decisions reverberate through every level of a healthcare organization, influencing policies, procedures, resource allocation, and ultimately, patient care [17]. Thus, understanding how administrative decisions impact patient safety culture is imperative for fostering an environment conducive to optimal patient outcomes.

The significance of administrative decision-making in healthcare cannot be overstated [18]. From staffing levels to budget allocations, administrative decisions dictate the operational framework within which healthcare professionals operate. In hindsight, one can discern the profound implications these decisions have had on patient safety culture.

One dimension of administrative decision-making lies in resource allocation [19]. Adequate staffing levels, access to necessary equipment, and ongoing training are essential components of ensuring patient safety. However, budget constraints often force administrators to make difficult decisions regarding resource allocation. In the past, some healthcare facilities may have prioritized cost-cutting measures over investments in patient safety. Consequently, this could have led to staff burnout, compromised patient care, and a weakened safety culture [20].

Moreover, administrative decisions regarding organizational structure can significantly impact patient safety culture. Hierarchical structures that stifle communication and discourage reporting of errors can hinder the development of a robust safety culture [21]. In contrast, organizations that foster transparency, accountability, and open communication channels tend to have a more resilient safety culture. Reflecting on past administrative decisions can unveil patterns that either facilitated or impeded the cultivation of such a culture [22].

Another critical aspect is the role of administrative policies and procedures. Policies that prioritize efficiency over safety, or fail to adapt to evolving best practices, can undermine patient safety culture. For instance, outdated medication reconciliation protocols or inadequate infection control measures could

increase the risk of adverse events [23]. Conversely, proactive policies that prioritize patient safety, such as implementing checklists or standardized protocols, can reinforce a culture of safety.

Furthermore, administrative decisions regarding staff training and development play a pivotal role. Investing in ongoing education and training programs demonstrates a commitment to continuous improvement in patient care [24]. Conversely, neglecting staff development can lead to outdated practices and a stagnant safety culture. Reflecting on past decisions regarding staff training can reveal areas for improvement and inform future strategies for fostering a culture of safety.

In hindsight, examining the impact of administrative decision-making on patient safety culture reveals a complex interplay of factors. Decisions made at the administrative level have far-reaching consequences that shape the ethos of patient safety within healthcare organizations. Recognizing the multifaceted nature of this impact is essential for effecting positive change [25].

Moving forward, healthcare administrators must prioritize patient safety in all decision-making processes. This entails not only allocating resources appropriately but also fostering a culture that values transparency, collaboration, and continuous learning. By reflecting on past decisions and their implications for patient safety culture, healthcare organizations can chart a course towards a safer and more effective healthcare system.

### **CONCLUSION:**

Administrative decisions played a pivotal role in shaping the safety culture within healthcare facilities. The study underscored the necessity of informed, transparent, and patient-centric administrative practices to foster a culture prioritizing safety. By recognizing the intricate interplay between decision-making and patient well-being, stakeholders could enact targeted interventions to enhance safety protocols and promote a culture of continuous improvement. This research serves as a cornerstone for future endeavors aimed at fortifying patient safety within healthcare institutions.

**Limitations:** This study was conducted at a single tertiary care hospital (Jinnah Hospital), limiting the implementation of outcomes to other healthcare settings. Self-reported survey may linked with bias.

**Recommendation:** It is recommended to investigate specific administrative decisions and their direct influence on patient safety outcomes.

### **REFERENCES:**

1. Chen IC, Lee Peng N, Hui Fuang N, Lok Sin K. Impacts of job-related stress and patient safety culture on patient safety outcomes among nurses in Taiwan. *International Journal of Healthcare Management*. 2021 Jan 2;14(1):1-9.
2. Simsekler MC, Qazi A, Alalami MA, Ellahham S, Ozonoff A. Evaluation of patient safety culture using a random forest algorithm. *Reliability Engineering & System Safety*. 2020 Dec 1;204:107186.
3. Makiah M, Noermijati N, Hadiwidjojo D, Moko W. Clinical leadership and knowledge management: Essential role in patient safety culture?. *Uncertain Supply Chain Management*. 2023;11(3):1295-304.
4. Kaya GK, Ustebay S, Nixon J, Pilbeam C, Sujana M. Exploring the impact of safety culture on incident reporting: Lessons learned from machine learning analysis of NHS England staff survey and incident data. *Safety science*. 2023 Oct 1;166:106260.
5. Afework A, Tamene A, Tesfaye A, Tafa A, Gemede S. Status and factors

- affecting patient safety culture at dilla university teaching hospital: a mixed-method cross-sectional study. *Risk Management and Healthcare Policy*. 2023 Dec 31;1157-69.
6. Armand TP, Carole KS, Bhattacharjee S, Mozumder MA, Amaechi AO, Kim HC. The benefits of integrating AI, IoT, and Blockchain in healthcare supply chain management: A multi-dimensional analysis with case study. In 2024 26th International Conference on Advanced Communications Technology (ICACT) 2024 Feb 4 (pp. 300-304). IEEE.
  7. Otitolaiye VO, Shah AA, Omer F. Organizational Factors, Critical Dimensions, and Measurement Instruments for Safety Culture: A Concise Review. *Petroleum & Coal*. 2022 Jan 1;64(1).
  8. Marchan SM. Knowledge and Perceptions of Patient Safety and Patient Safety Culture in a Dental School: A Qualitative Study (Doctoral dissertation, American College of Education).
  9. Fan C. Empowering Excluded Groups: a Multi-dimensional Analysis of China's Anti-poverty Policies Through the Lens of Amartya Sen's Capability Perspective. *Journal of the Knowledge Economy*. 2023 Dec 28;1-29.
  10. Fatima S, Desouza KC, Dawson GS. National strategic artificial intelligence plans: A multi-dimensional analysis. *Economic Analysis and Policy*. 2020 Sep 1;67:178-94.
  11. Odumodu CU. A decision-making framework for assessing the safety culture of maritime organizations with commercial cargo-carrying vessels.
  12. Campbell K, Gardner A, Scott DJ, Johnson J, Harvey J, Kazley A. Interprofessional staff perspectives on the adoption of or black box technology and simulations to improve patient safety: a multi-methods survey. *Advances in Simulation*. 2023 Oct 25;8(1):24.
  13. Alfahd H. The Influence of Nurse-Caring Factors on Patient Safety Culture (Doctoral dissertation, Florida Atlantic University).
  14. Reader TW. Stakeholder safety communication: patient and family reports on safety risks in hospitals. *Journal of Risk Research*. 2022 Aug 1;25(7):807-24.
  15. Shen Y, Li Y, Ju C, Ashraf H, Hu Z, He C, Memon SA. Foundational effects of organizational climate on perceived safety climate: A multiple mediation model. *Sustainability*. 2023 Nov 8;15(22):15759.
  16. Alderei B, Nammari R, Alalami MA, Rodrigues C, Qazi A, Simsekler MC. Evaluating Patient Safety Drivers using Decision Trees. In 2022 Advances in Science and Engineering Technology International Conferences (ASET) 2022 Feb 21 (pp. 1-5). IEEE.
  17. Wang D, Wan K, Ma W. Emergency decision-making model of environmental emergencies based on case-based reasoning method. *Journal of environmental management*. 2020 May 15;262:110382.
  18. Brubakk K. Taking care of the caregivers. How characteristics of work environment affect patient safety.
  19. Sprogis SK, Currey J, Jones D, Considine J. Exploring interdisciplinary communication pathways for escalating pre-medical emergency team deterioration: a mixed-methods study. *Australian Health Review*. 2023 Jul 18;47(4):494-501.

20. De Micco F, De Benedictis A, Fineschi V, Frati P, Ciccozzi M, Pecchia L, Alloni R, Petrosillo N, Filippi S, Ghilardi G, Campanozzi LL. From syndemic lesson after COVID-19 pandemic to a “systemic clinical risk management” proposal in the perspective of the ethics of job well done. *International Journal of Environmental Research and Public Health*. 2021 Dec 21;19(1):15.
21. Dieke CC, Udeh IE, Nwenekorum FK. Effect of Organizational Culture on the Performance of Tertiary Health Institutions in Enugu State. *Global Journal of Finance and Business Review* | ISSN. 2024;1694:450X.
22. Farshadmanesh P, Beal J, Sakurahara T, Reihani S, Kee E, Rowell A, Yilmaz F, Mohaghegh Z. Modeling interconnections of safety and financial performance of nuclear power plants part 1: Categorical review and theoretical bases. *Progress in Nuclear Energy*. 2024 Jun 1;171:105123.
23. Ni M, Borsci S, Walne S, Mclister AP, Buckle P, Barlow JG, Hanna GB. The Lean and Agile Multi-dimensional Process (LAMP)—a new framework for rapid and iterative evidence generation to support health-care technology design and development. *Expert review of medical devices*. 2020 Apr 2;17(4):277-88.
24. Tangsgaard ER. Risk management in public service delivery: multi-dimensional scale development and validation. *International Public Management Journal*. 2022 Dec 1;25(7):1005-26.
25. Hopcraft R, Tam K, Dorje Palbar Misas J, Moara-Nkwe K, Jones K. Developing a maritime cyber safety culture: Improving safety of operations.