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Contents

Enhancing Medical Claim Approval Efficiency and Patient Satisfaction: An In-Depth Analysis of Third-Party Administrator (TPA) Rejections at Tertiary Care Hospital

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Abstract

Background: Cashless medical claim denials by Third-Party Administrators (TPAs) can lead to financial burdens and dissatisfaction among patients.

Objective: To analyze TPA rejections at a tertiary care hospital, identify factors contributing to cashless denials, and suggest measures to enhance claim approval efficiency and patient satisfaction.

Methods: The data for this study was collected through a retrospective approach from a period of March 2023 to December 2023. The dataset included information related to Mediclaim claim rejections, patient details, comments from TPAs, discharge notes, and hospital remarks.

Results: The study revealed a 25% cashless denial rate, primarily due to inadequate documentation,40% followed by TPA response time delays and claim type discrepancies and (35%). Disease categories with highest denial rates were identified.

Conclusion: The pivotal role played by Third-Party Administrators (TPAs) in facilitating the smooth disbursement of mediclaims and contributing significantly to the hospital's revenue stream was evident. However, the study revealed that despite the critical role of TPAs, a considerable number of mediclaim rejections were occurring, leading to conflicts between the hospital, patients, and their families.

Keyword: Mediclaim; TPA; Claim; Denial; Revenue.

INTRODUCTION

In the complex landscape of modern healthcare, the relationship between hospitals, Third-Party Administrators (TPAs), and the insurance industry plays a pivotal role in ensuring efficient patient care, streamlined revenue cycles, and overall satisfaction for patients and healthcare providers. This intricate interplay between these entities has far-reaching implications for both the financial viability of healthcare institutions and the quality of care delivered to patients. Hospitals and TPAs: Hospitals are not just places for medical treatment; they are also intricate financial entities with diverse revenue streams. A substantial portion of a hospital's revenue often hinges on patients who are covered under various insurance schemes. These insured patients, whether under private insurance policies or state-sponsored government schemes, are required to file medical claims with TPAs when seeking healthcare services at hospitals. TPAs, or Third-Party Administrators, act as indispensable intermediaries in this process. Their role extends

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far beyond mere paperwork; they are entrusted with a wide array of responsibilities, including documentation, verification, claim adjudication, and numerous other tasks essential for the seamless management of medical claims. TPAs serve as the liaison between the insurance company, the healthcare provider (the hospital), and the patient, ensuring that the claims process is executed smoothly and efficiently.

The Role of TPAs: 1. ***Documentation and Verification:*** TPAs are responsible for collecting, reviewing, and verifying the documentation submitted by patients for medical claims. This documentation includes medical records, bills, and other necessary paperwork. **2.** ***Claim Adjudication:*** TPAs assess the validity of claims based on policy terms, medical necessity, and other criteria. They determine whether a claim should be approved, partially approved, or denied. **3.** ***Financial Intermediaries:*** TPAs handle financial transactions related to medical claims. They facilitate payments from insurance companies to hospitals and, in some cases, reimburse patients for their medical expenses. **4.** ***Communication Hub:*** TPAs facilitate communication between the hospital and the insurance company. They ensure that the necessary information is exchanged promptly to expedite the claims process. **5.** ***Patient Advocacy:*** TPAs also serve as advocates for patients. They assist patients in understanding their insurance policies, coverage limitations, and the claims process, helping them navigate complex healthcare systems.

Some prominent TPAs are:

1. ***Medi Assist India TPA Pvt. Ltd.:*** Medi Assist is one of India's leading TPAs, specializing in health insurance claims processing and related services.
2. ***Paramount Health Services and Insurance TPA Pvt. Ltd.:*** Paramount Health Services is a prominent TPA known for its expertise in claims administration and healthcare management.
3. ***Vidal Health TPA Pvt. Ltd.:*** Vidal Health is a trusted TPA in India that offers a range of healthcare management solutions, including claim processing.
4. ***MD India Healthcare Services (TPA) Pvt. Ltd.:*** MD India Healthcare Services is a well-established TPA with a strong presence in the health insurance sector.
5. ***FHPL (Family Health Plan Insurance TPA Limited):*** FHPL is a leading TPA that provides a wide range of healthcare services, including claims processing and network management.
6. ***Raksha TPA Pvt. Ltd.:*** Raksha TPA is known for its efficient claims processing services and is a recognized name in the industry.
7. ***Vipul MedCorp TPA Pvt. Ltd.:*** Vipul MedCorp is a TPA that offers comprehensive healthcare services, including claims management and assistance to policyholders.
8. ***Heritage Health TPA Pvt. Ltd.:*** Heritage Health TPA is known for its commitment to quality healthcare services and efficient claims processing.
9. ***Chola MS General Insurance TPA Pvt. Ltd.:*** Chola MS is a well-known TPA that provides healthcare solutions, including claims management, for various insurance companies.
10. ***ICICI Lombard Health Care:*** ICICI Lombard offers TPA services in addition to its insurance offerings, specializing in claims processing and customer support.
11. ***Reliance General Insurance Company Ltd.:*** Reliance General Insurance also provides TPA services, including claims adjudication, as part of its insurance offerings.
12. ***Bajaj Allianz General Insurance Company:*** Bajaj Allianz, a prominent insurance company, offers TPA services for efficient claims processing and customer support.

Processes Followed by TPAs in Hospitals:

TPAs play a critical role in the claims management process within hospitals. Here are the key processes they follow:

1. ***Documentation Verification:*** TPAs collect and verify all the necessary documentation from patients. This includes medical records, bills, prescriptions, and other relevant documents to substantiate the claim
2. ***Claim Adjudication:*** TPAs assess the validity of claims based on the terms and conditions of the insurance policy. They determine whether the treatment is covered, medically necessary, and compliant with the policy guidelines.
3. ***Financial Transactions:*** TPAs handle financial transactions related to claims. They coordinate the payment process, ensuring that hospitals are reimbursed for their services and that patients receive their entitled benefits.

4. ***Communication:*** TPAs facilitate communication between the hospital, the insurance company, and the patient. They ensure that all parties are informed about the progress of the claim and any additional information required.
5. ***Claim Settlement:*** TPAs assist in settling claims promptly and accurately. They calculate the amount to be paid to the hospital and coordinate the payment from the insurance company.

Claim rejection:

Health insurance claims rejection refers to the situation where an insurance company or Third Party Administrator (TPA) denies or refuses to pay a medical expense that a policyholder or patient has submitted for reimbursement or coverage. Health insurance claims in India can be denied, according to the Insurance Regulatory and Development Authority of India (IRDAI):

1. ***Non-disclosure of pre-existing diseases:*** If you do not disclose any pre-existing diseases you have when taking the health insurance policy, your claim to treat these diseases can be denied.
2. ***Waiting period:*** Most health insurance policies have a waiting period for certain diseases. This means you will not be covered for these diseases until the waiting period ends.t
3. ***Claims made outside the policy terms and conditions:*** If a patient makes a claim not covered by their health insurance policy, it will be denied.
4. ***Late submission of claim documents:*** If a patient does not submit the documents within the stipulated period, their claim may be denied.
5. ***Fraudulent claims:*** If the insurance company finds a patient has made any fraudulent claim, it can deny it.
6. ***Lapse of policy:*** If a patient's health insurance policy lapses due to non-payment of premium, their claims will not be honored.

Additional reasons why health insurance claims can be denied in India:

1. ***Treatment received at a non-network hospital:*** If a patient is admitted to a hospital not in their health insurance network, their claim may be denied.
2. ***Treatment not authorised by the insurance company:*** If a patient does not get prior authorisation from the insurance company for a certain treatment, their claim may be denied.
3. ***Claims for experimental or cosmetic treatments:*** Health insurance policies typically do not cover experimental or cosmetic treatments
4. ***Claims for pre-existing diseases after the waiting period is over:*** Even after it is over, a patient's health insurance policy may not cover pre-existing diseases if they have worsened.

Insurance Company	Network Hospitals	Claim Settlement Ratio for year 2022-23	Incurred Claim Ratio
Edelweiss General Claim Settlement Ratio (CSR)	Over 2,578	85.57%	113.05%
Star Health and Allied Claim Settlement Ratio (CSR)	Over 9,900	78.62%	65.91%
Kotak Mahindra Claim Settlement Ratio (CSR)	Over 4,000	96.38%	49.22%
HDFC ERGO Claim Settlement Ratio (CSR)	Over 10,000	86.52%	73.69%
IFFCO Tokio Claim Settlement Ratio (CSR)	Over 5,000	96.33%	95.66%
ICICI Lombard Claim Settlement Ratio (CSR)	Over 5,025	99.98%	81.96%
Bajaj Allianz Claim Settlement Ratio (CSR)	Over 6,500	92.24%	89.36%
Care Health Claim Settlement Ratio (CSR)	Over 8,250	92.83%	103.30%
Reliance General Claim Settlement Ratio (CSR)	Over 7,300	96.93%	69.90%

Payment to TPAs:

Third-Party Administrators (TPAs) are typically paid by the insurance companies or health plans that contract their services. Insurance companies hire TPAs to handle various administrative tasks, including claims processing, on their behalf. The fees or compensation for TPAs are usually negotiated between the insurance company and the TPA. The payment structure can vary, but it often includes a fee for each claim processed or a fixed annual fee.

In essence, the smooth functioning of both the medi claim process and the TPA department is a prerequisite for the fluid operations of hospitals. The revenue generated from insured patients is vital for sustaining healthcare institutions, making the collaboration between hospitals, TPAs, and the insurance industry an integral part of the healthcare ecosystem. Any disruptions or inefficiencies in this interplay can lead to delayed responses, conflicts, and a less than optimal patient experience. Therefore, understanding, analyzing, and optimizing the roles of TPAs, alongside the broader insurance industry dynamics, is essential for the financial health and patient satisfaction of hospitals.

OBJECTIVES

1. ***Identify Reasons for Claim Rejections:*** The primary objective of this study is to identify the reasons behind the rejection of mediclaim claims processed by various Third-Party Administrators (TPAs) in the hospital.
2. ***Categorize Rejection Reasons:*** To categorize the identified rejection reasons into broader thematic groups, facilitating a comprehensive understanding of the underlying causes.
3. ***Prioritize Rejection Themes:*** Prioritize rejection themes by analyzing the frequency of appearance, focusing on the most prevalent reasons that contribute to the majority of claim rejections.
4. ***Develop Recommendations:*** Formulate practical recommendations for addressing the identified rejection themes, both at the hospital and TPA levels, to minimize claim rejections and improve the mediclaim process's efficiency.

METHODOLOGY

The data for this study was collected through a retrospective approach from March 2023 to December 2023. The dataset included information related to Mediclaim claim rejections, patient details, comments from TPAs, discharge notes, and hospital remarks.

1. **Data Cleaning and Organization:**
   - ***Data Cleaning:*** Clean the dataset by addressing missing values, inconsistencies, and errors. This step is crucial for ensuring the dataset's quality and reliability.
   - ***Data Organization:*** Organize the cleaned dataset into relevant headings and categories to create a structured and easily navigable dataset for analysis.
2. **Thematic Analysis:**
   - ***Identification of Reasons:*** Conduct a thematic analysis of the dataset to identify the reasons for mediclaim claim rejections. This involves reviewing each rejection case and categorizing them based on common themes.
   - ***Categorization into Broad Themes:*** Categorize the identified reasons into broader thematic groups. This step helps in creating a comprehensive understanding of the rejection landscape.
3. **Frequency Analysis:**
   - ***Counting Reason Frequencies:*** Count the frequency of each identified reason for rejection within the dataset. This analysis highlights which rejection themes are more prevalent.
4. **Pareto Analysis:**
   - ***Prioritization of Themes:*** Use Pareto analysis to prioritize rejection themes. Identify the top 20% of themes that contribute to 80% of the claim rejections. This step helps in focusing on the most critical issues.
5. **TPA-Wise Analysis:**
   - ***Analysis by TPA Companies:*** Conduct a detailed analysis of claim rejections specific to each TPA company operating within the hospital's network. Determine which TPAs have the highest number of claim rejections.
   - ***High Alert Companies:*** Identify TPAs with a larger share in claim rejection proportion. Earmark these TPAs as high-alert companies, requiring careful handling from an operational perspective.

OBSERVATIONS & FINDINGS

Reasons for Rejection: Through meticulous data cleaning and analysis, 350 distinct reasons for mediclaim rejection were identified. These reasons ranged from administrative discrepancies to documentation errors.

Categorization into Broad Themes: The identified reasons were further categorized into 22 broad themes, providing a structured framework to understand rejection patterns. This categorization aided in simplifying the complex data.

Priority Themes: Employing Pareto analysis, it became apparent that a subset of themes accounted for the majority of claim rejections. Identifying these priority themes allows for focused improvement efforts.

Pareto Analysis Visualization: A Pareto Chart was generated to visually highlight the priority themes, making it easier to grasp the critical areas that need immediate attention.

TPA-specific Analysis: The analysis at the TPA level revealed variations in claim rejection frequencies among different TPA companies. Some TPAs had notably higher rejection rates, necessitating their categorization as high-alert companies.

High-Alert TPAs: Six TPAs were identified as high-alert due to their significant contribution to claim rejections. These TPAs require tailored strategies for claim management and patient satisfaction.

Sub-Segmentation of Themes: Sub-segmentation at the TPA level allowed for a deeper understanding of rejection themes within each TPA company. This fine-grained analysis provides practical insights for crafting TPA-specific recommendations.

Table 1: Major identified themes with frequency

Themes	Count	Cumulative frequency
Waiting Period Issues	50	50
Authorization and Review	36	86
Miscellaneous Reasons	27	113
Pre-existing Conditions	26	139
Documentation	22	161
Cashless Facility Utilization	19	180
Policy Limitations	19	199
Non-disclosure and Misrepresentation	19	218
Duration Uncertainty	17	235
OPD and Diagnostic Services	16	251
Procedural Issues (80%)	14	265
Claim Justification	10	275

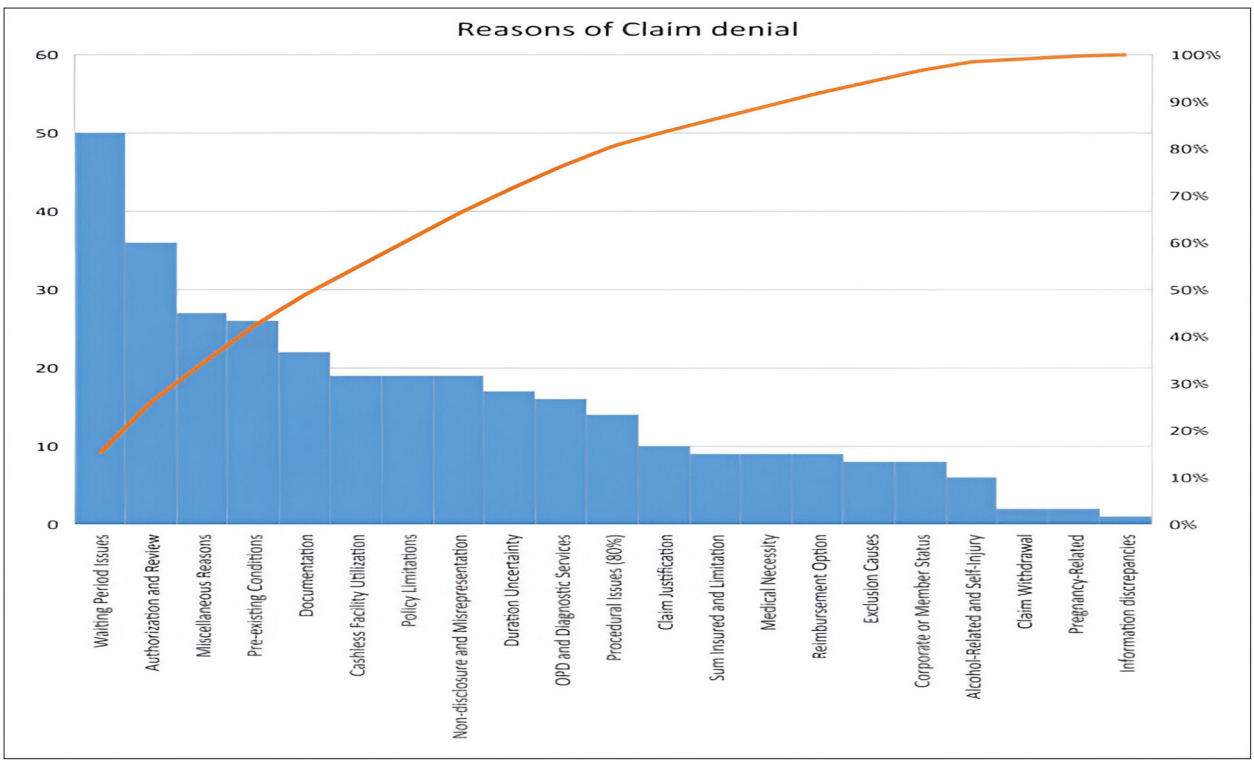


Fig. 1: Pareto chart showing themes of rejections

Explanation of Themes

- **Waiting Period Issues:** This theme likely relates to claims being rejected due to patients seeking coverage for conditions or treatments that fall within a waiting period stipulated by their insurance policy. Many policies have waiting periods during which certain conditions or treatments are not covered.
- **Authorization and Review:** This theme suggests that some claims may be rejected because they lack proper authorization or have not undergone the necessary review process by the insurance company or TPA.
- **Miscellaneous Reasons:** This category likely encompasses a range of diverse and less common reasons for claim rejections that don't fit neatly into other predefined categories.
- **Pre-existing Conditions:** Claims under this theme may be rejected when patients seek coverage for conditions that were pre-existing, meaning they existed before the insurance policy's effective date.
- **Documentation:** Claims in this category might have been rejected due to insufficient or inaccurate documentation provided by the patient or healthcare provider. Proper documentation is crucial for claim approval.
- **Cashless Facility Utilization:** This theme suggests that claims related to cashless facility utilization may face issues, possibly due to discrepancies in the utilization process.
- **Policy Limitations:** Claims may be rejected if they exceed the policy's coverage limitations or if the treatment or condition is not covered under the policy.
- **Non-disclosure and Misrepresentation:** This category could involve claims that were rejected because the patient failed to disclose relevant information during the policy application or misrepresented facts.
- **Duration Uncertainty:** Claims under this theme might be related to uncertainty or ambiguity regarding the duration of treatment or recovery, which can affect claim approval.
- **OPD and Diagnostic Services:** Claims related to outpatient department (OPD) services and diagnostic tests may face specific challenges or requirements leading to rejections.
- **Procedural Issues:** This theme, with a high percentage, indicates that a substantial number of claims were rejected due to procedural issues. These could involve errors or omissions in the claim filing process.
- **Claim Justification:** Some claims may require additional justification or documentation to demonstrate the medical necessity or appropriateness of the treatment.
- **Sum Insured and Limitation:** Rejections under this theme could be tied to claims that exceed the sum insured or coverage limitations defined in the policy.
- **Medical Necessity:** Claims may be rejected if the insurance company or TPA deems the treatment or procedure as not medically necessary or justified.
- **Reimbursement Option:** This theme may involve claims for which patients opted for reimbursement rather than cashless treatment, leading to specific considerations or requirements.
- **Exclusion Causes:** Claims related to conditions or treatments explicitly excluded from coverage in the policy may be rejected.
- **Corporate or Member Status:** Some claims may be tied to the corporate or membership status of the insured individual, leading to specific processing requirements.
- **Alcohol-Related and Self-Injury:** Claims associated with injuries or conditions resulting from alcohol use or self-inflicted injuries may be subject to special scrutiny.
- **Claim Withdrawal:** Patients may withdraw their claims for various reasons, and these instances might be categorized under this theme.
- **Pregnancy-Related:** Claims related to pregnancy and maternity care may have unique considerations and requirements.
- **Information discrepancies:** Claims with discrepancies or inconsistencies in the information provided may be subject to rejection until these issues are resolved.

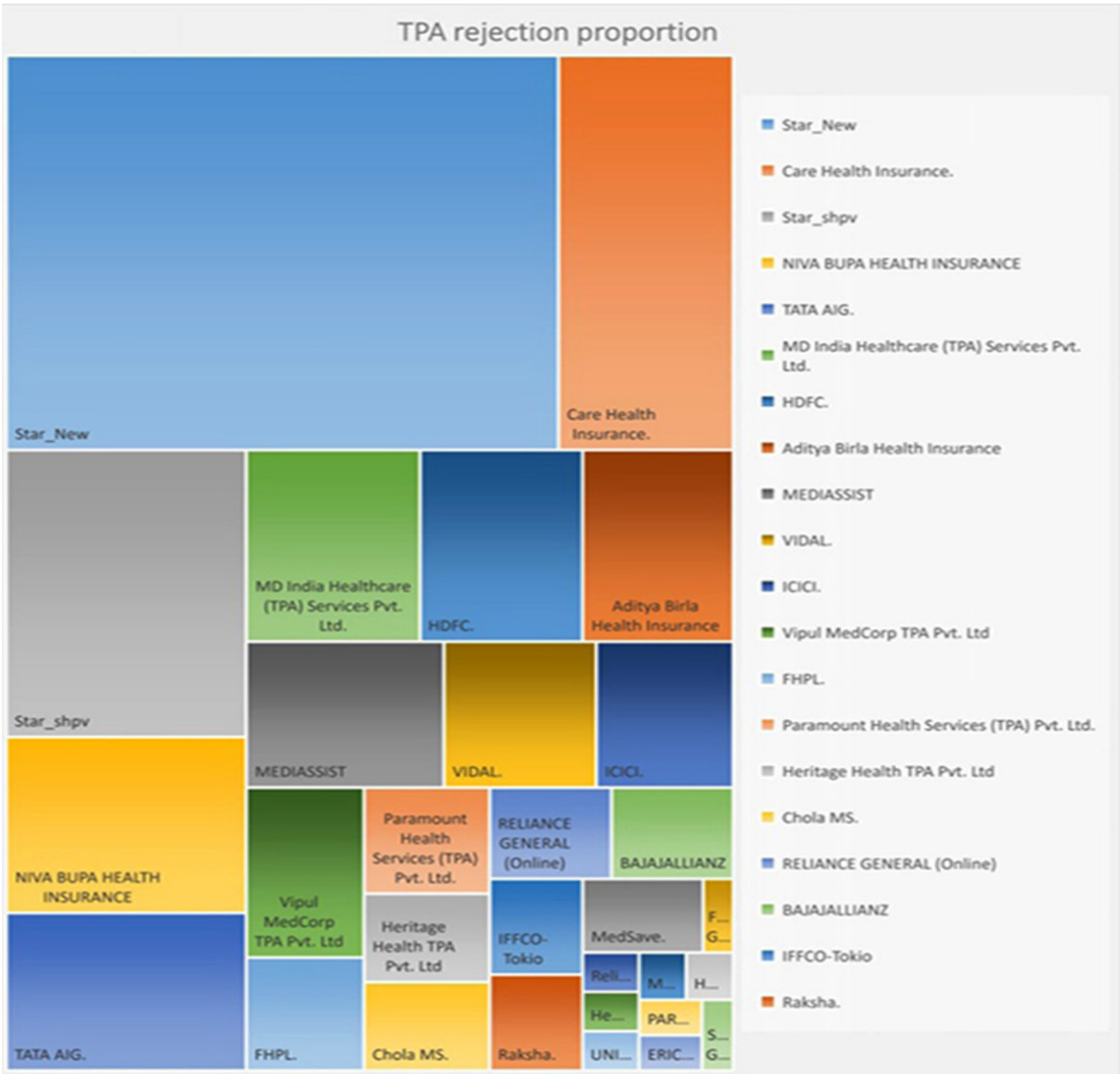
Table 2: TPA Wise Distribution

Payer TPA	TPA acount
Star New	98
Care Health Insurance	31
Star SHPV	31

Table Cont...

Niva Bupa Health Insurance	19
TATA AIG	17
MD India Healthcare (TPA) Services Pvt. Ltd.	15
HDFC	14
Aditya Birla Health Insurance	13
Mediassist	13
Vidal	10
ICICI	9
Vipul MedCorp TPA Pvt. Ltd	9
FHPL	6
Paramount Health Services (TPA) Pvt. Ltd.	6
Heritage Health TPA Pvt. Ltd.	5
Chola MS.	5
Reliance General (Online)	5

Bajaj Allianz	5
IFFCO-Tokio	4
Raksha	4
MedSave	4
Future Generali	1
Reliance General Insurance Company Ltd.	1
Health India TPA	1
Universal Sompo General Insurance Company	1
Medvantage Insurance TPA Private Limited	1
Health Insurance TPA India Ltd.	1
Paramount Health (Online)	1
Ericson TPA healthcare Pvt. Ltd.	1
SBI General Insurance	1



CONCLUSION

In conclusion, this study delved into the complex landscape of mediclaim processing within the context of a prominent hospital, Bombay Hospital. The pivotal role played by Third-Party Administrators (TPAs) in facilitating the smooth disbursement of mediclaims and contributing significantly to the hospital's revenue stream was evident. However, the study revealed that despite the critical role of TPAs, a considerable number of mediclaim rejections were occurring, leading to conflicts between the hospital, patients, and their families.

The primary objective of this study was to identify the reasons behind these rejections and categorize them into thematic areas through a meticulous analysis of retrospective data, comments from TPAs, discharge notes, and hospital remarks. Through this analysis, we successfully identified 22 broad themes encompassing various rejection reasons.

The findings highlighted several key areas that required attention to reduce the rejection ratio effectively. These included issues related to waiting periods, authorization and review processes, documentation, pre-existing conditions, and policy limitations. Additionally, non-disclosure and misrepresentation, duration uncertainty, procedural issues, claim justification, and medical necessity also played significant roles in claim rejections.

The study further scrutinized TPA-wise rejection patterns, pinpointing high-alert TPA companies with a higher share of claim rejections. This knowledge enabled the hospital to focus on addressing issues related to these specific TPAs more diligently, ultimately improving operational efficiency.

To complement the data-driven analysis, the study included questionnaires for hospital staff and TPA desk staff. These questionnaires unveiled practical insights into the delay in discharges, common medical process errors, denial reasons from the TPA end, and queries and documents requested from patients filing mediclaim.

Based on the comprehensive analysis and feedback received from stakeholders, a set of recommendations and actionable measures were formulated to minimize claim rejections. These recommendations spanned the entire process, from policy verification and documentation to fraud detection and customer service, ensuring a more seamless and patient-centric mediclaim experience.

Furthermore, the study emphasized the importance of patient education and awareness by developing a detailed checklist for insured patients to review their policy criteria before admission, minimizing the risk of rejection. Similarly, guidelines were formulated for hospital staff to ensure adherence to industry recognized clinical pathways and prevent potential fraud suspicions.

In sum, this study offers a valuable roadmap for Bombay Hospital and similar healthcare institutions to enhance their mediclaim processing efficiency, reduce claim rejections, improve patient satisfaction, and bolster revenue cycles. By addressing the identified issues and implementing the recommended measures, the hospital can strive for a future where mediclaim processing becomes a seamless and conflict-free process for all stakeholders involved.

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Role of Artificial Intelligence in Medical Jurisprudence: Opportunities & Challenges

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Abstract

The upcoming Industrial transformation will be distinguished by the dominion of Artificial Intelligence (AI). The domain of Medical Jurisprudenceispivotal to criminal inquiries. AI has the capability to prevail over countless of the constraints linked with the conventional procedures of regulating post-mortem examinations & framing inferences. AI will be pivotal in framing various inferences of medico-legal significance in Medical juridical approaches such as toxicological examination, collection of various specimens of medico-legal significance from cavities, recognition of pathologies in various organs, recognition of various stains, recognition of a weapon of offence, post-mortem interval calculations & so on. AI can also be incorporated into presently used investigation & examination approaches to speed up & boost the precision of the procedure as a whole. AI will play a pivotal role in Medical Jurisprudence in future.

Keyword: Medical Jurisprudence; AI; Medico-Legal Post-Mortem Examination; Toxicology.

INTRODUCTION

The 4th Industrial transformation is drastically modifying several quarters today. The latest mainstay of all computational transfiguration projects is AI. The utilization of AI has raised over the past couple of years across a huge range of industrial sectors, including health-care services. Now-a-days, AI is being used to recognize various carcinomas, track & recognize vital clinical features, & even help doctors detect & diagnose patients more precisely. The utilization of AI in the examination of biological materials has enormous probability in the domain of toxicology. AI has the probability to transform the domains of Medical Jurisprudence since it can help experts in their individual domains with strenuous analytical functions.[1,2] This paper examines the probable consequences of AI on the domains of Medical Jurisprudence, as well as the situations that must be met for AI to have a pivotal impact in these domains.

Terminologies Related to AI

AI: The earliest definition, furnished by its creator Alan Turing, was given as the science & engineering of developing smart tools, particularly smart computer programs. As of right now, a precise definition might be an organization's (computer) capacity to accurately read outside information & utilization of that information to modify itself in a flexible way to accomplish particular objectives.

Machine Learning (ML): The statistical procedure of fitting models to information & learning via instruction models on informationis known as Machine learning.

Precision therapeutics: predicting the course

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of therapy that will most likely have the greatest impact on the patient. It is the area of therapeutics where tool learning is most frequently applied. A set of instruction information for which the end variable (such as the onset of a disease) is known is necessary for precision therapeutics to function. This procedure is known as supervised learning.

Deep Learning (DL): A deep neural matrix with a specific configuration of neurons arranged in multiple successive layers is known as a deep learning matrix, which is a subcategory of tool learning.

REVIEW

What isMedical Jurisprudence?

The utilization of medical speciality to criminal inquiries, administration of justice & the legal organization is known as Medical jurisprudence which also includes toxicology. Toxicology's principal objective is to investigate how chemicals, both naturally occurring & manufactured, affect human health. Toxicology has countless sub-specialties.[3,4]

AI IN MEDICAL JURISPRUDENCE:

Developing smart tools with cognitive capabilities is a constituent of AI. The traditional post-mortem examination procedure has countless disadvantages, including the want for expert person in each instance, the probability for human variance in the phrasing of inferences at some stages, & the in capacity to see meticulous details with the naked human eye. To counter these, medical jurisprudence experts urgently need to apply innovative technologies. Tool learning includes deep learning, which has the ability to learn from images. This can be applied to calculate the age of skeletal bones. The three-dimensional conventional neural matrix, or 3D CNN, is highly utilized for medico-legal anthropological functions & is capable of performing both generative & descriptive functions. It learns in three dimensions. By estimating soft tissue thickness from the skulls, it can be utilized in medical jurisprudence to detect age, sex, vector forecasts, & cephalometric landmark an notations. Cone Beam Computed Tomography scans of the head are typically the source of input. It is a superior organization with no subjective bias & no fatigue. It can also be helpful in cases of sudden death by assessing hard tissues & hidden damage that might have contributed to the death.

In the domain of medical jurisprudence, recognition is pivotal since it's needed to recognize criminals, recognize a dead person who is unknown, & recognize victims of catastrophes both natural & manmade. The conventional procedure of recognition includes physical marks, scars, tattoos, anthropology, & face descriptions etc. DNA examination & finger-printing are two landmark procedures that have been developed. However, the development of AI has made it possible for tools to verify recognition. A tool will electronically record information when it receives input of different body factors, such as finger-prints, retinal arrangements, & face traits. The tool can utilization AI to detect a person's recognition by employing these variables, which are already electronically stored in the organization. For the purpose of establishing identity, a tool can be furnished a variety of variables, such as voice, palm print, DNA, facial features, iris, finger-print, & gait arrangements. Biometry is the recognition of aperson based on biological information. When aperson presents the computer with their unique bio-metric arrangement for example, their finger-print, it will instantly recognize them by contrasting it to the bio-metric arrangement that it has already stored. Therefore, by contrasting the bio-metric arrangement presented to a tool with the bio-metric information already stored at the tool, aperson's identity can be substantiated. The organization will need the bio-metric information of every person living in a specific area in order to apply this methodology to a huge population. This bio-metric procedure will be very helpful in establishing a person's identity.[5-7]

A more recent development in the realm of medical jurisprudence is the application of AI to enhance virtual post-mortem examinations. CT & MRI scans will be utilized to help tool learning algorithms obtain images of the body. Based on the photos, the tool will detect the diseased state of an organ by contrasting it with the large quantity of input information that it has been given. After processing the information, the organization will detect the organs' illness state & probably even the reason of death. One can formulate inferences about deep injuries, small fractures, organ disease, & tissue inflammation.

By examining the extent of the damage & contrasting it with the diverse arrangements of damage caused by other weapon kinds, the approach can also furnish an inference about the sort of weapon employed. Additionally, the

methodology will aid in the gathering of specimens from specific organ diseased locations & aid in the establishment of a precise disease diagnosis. In the domains of medical jurisprudence & criminal inquiry, the computation of time since death is a pivotal constituent. Blood contains a number of determinants that can be utilized to calculate the time since death. An AI organization can procedure these blood signs to furnish an accurate assessment about the period since death. Different body specimens can be processed using a variety of modern chemical examination methodologies for medico-legal toxicological examination. A few of the procedures include high-accomplishment liquid chromatography, chromatography, neutron activation examination, & light spectroscopy.[8,9] An algorithm suite is fed into a tool so that it can analyse the specimen more accurately & with less time investment than it would have with a conventional examination procedure. Certain constituents of toxicological testing can also be automated by combining AI with robotics. Robots, for instance, can be utilized to accurately gather & move specimens. Medico-legal specialists stand to gain a great deal from AI, which might boost productivity, cut expenses, boost precision, & open up new avenues for toxicological inquiry.[10]

In addition, AI may be applied in the following domains: (i) disease surveillance, where it can be utilized to recognize odd illness outbreaks, & (ii) disease diagnosis, where it can assist in the recognition of diseases using medical imaging methodologies like CT, MRI, & PET scans. The monitoring of pathogens, including bacteria, fungus, & other infectious diseases, as well as their evolution, is part of this. (iii) Medico-legal post-mortem examination & pathology, where AI can assist in recognizing the pathological cause of death. Pathology & post-mortem examination reports are frequently lengthy, laborious papers. By highlighting principal facts & inferences, AI can assist in condensing these materials. (iv) AI can be utilized in toxicology examination to look into the existence of substances & poisons in biological specimens including blood, urine, hair, saliva, & skin. (v) Substance Abuse: AI can detect arrangements in the substance abuse environment by utilizing substance testing software. AI can also be utilized to recognize usage arrangements that are odd or aberrant.[11]

The suffix "omics" is utilized in several biological domains, including toxicogen-omics, prote-omics, metabol-omics, Transcript-omics & gen-omics. Large amounts of scientific information are involved in omics technologies, which are useful in the medico-legal area for calculating post-mortem intervals, diagnosing illnesses, & examining substance misuse & poisoning situations. Omics information from countless platforms is being used more & more in medico-legal researches across all domains. In the event of an accident, for instance, genomics research can be utilized to calculate the age of the injury by examining DNA microarray examination of the skeletal muscle specimens. The development of omics technologies, which generate vast volumes of information in the domains of gene expression, protein measurement, metabolite levels, & microbial interaction, has benefited in the boost of biological & medical research. Omics information can be combined with tool learning algorithms. Later, this tool information can be utilized in medical jurisprudence to detect diseases & find different bio-determinants. Countless information types, information examination, & mathematical modelling based on omics technology can be employed in medical jurisprudence researches.[12,13]

Limitations of AI in Medical Jurisprudence: For accurate explication, an AI tool needs a considerable information feed. For the tool to be able to learn from the information & be taught in several principal areas of medical jurisprudence by medico-legal experts, high-quality, large-scale information is necessary in order for the tool to be able to evaluate post-mortem examination outcomes & furnish a sound inference. Specialists in medical jurisprudence must first manually elucidate documents & photos with principal discoveries, inferences & other information for computers.

AI is merely an automated instrument. It cannot take the place of information & human contact. Human labour will be needed for each piece of information that is furnished to the computer. Therefore, medico-legal experts will need to invest a great deal of time & effort in instruction the computer at first & ongoing information updates are also required. It's possible that different AI tools can't communicate with one another. The outcome of this could be the emergence of information silos. There will be effort duplication as anoutcome. Every piece of documented proof must be presented orally by the specialist witness in a court of law. Hence, the most pivotal question in the realm of medical jurisprudence is whether the inference generated by AI will be admitted as proof in a court of law. It is well known that countless people in impoverished nations like India cannot afford access to modern healthcare facilities. Therefore,

legislators will have a very tough time developing high-tech framework in the domain of medical jurisprudence.

CONCLUSION

Policymakers in developing nations like India will have pivotal challenges in setting up high-tech framework in the domain of medical jurisprudence because the healthcare organization is still in its infancy & is primarily concentrated in metropolitan regions. Presently, providing access to healthcare for all citizens in every region of developing nations is their top objective. Therefore, given the state of the healthcare organization in a developing nation like India, AI-assisted medical jurisprudence practice can be launched as a trial project at a few selected centres. A phased approach to expanding such a strategy to broader areas can be taken after evaluating its utility.

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Acceptance of Hospital Information Management to Improve the Quality of Healthcare in a Teaching Dental Hospital of Visakhapatnam City: A Mixed-Method Study

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Abstract

A health information management system (HIMS) has a set of components (technical, organizational, behavioral) and procedures "organized to generate information to improve health management decisions at all levels of the health system" and also for decision-making process in hospital. Engaging clinicians and other hospital personnel, including nurses, as wellas providing strong institutional support, is critical to the successful implementation and operation of a HIMS in hospitals.

Aim:

To assess the acceptance of a hospital information system to improve healthcare quality in a teaching hospital of Visakhapatnam city.

Methodology:

An Institution-based mixed-method study both quantitative and qualitative data collection methods was conducted at Teaching Hospital of Visakhapatnam city for duration of 3 months. A total sample of 80 health care workers (HCWs) working in Teaching Hospital, who were managing administrative hospital staff, heading sub-process, departments, and nurses were enrolled in the present study.

Results:

Most (38.40%) of our participants belonged to the age group of 25–35 years. The majority (45.60%) of them were females. The majority (69.70%) of them had bachelor's degrees and 65% had work experience from 0-5 years.

Keyword: Hospital Information Management; HIMS; Mixed-method; Quality of Healthcare; Acceptance.

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INTRODUCTION

Information is the crux of overall building blocks of health systems strengthening and availability of information will enable health managers to utilize the same for better policy-making, planning, implementation, and monitoring and evaluation of health care services provided in a hospital. The goal of computerized HIS is to use computers and communicational equipment to collect, save, process, extract, and link patient care information to management information; in other words, in this system, data are simultaneously saved in a database, so that they can be available for authorized users with a structure adapted to

the user's specific needs, where and when needed.[1] Hospital information systems (HIS) can support the improvement of healthcare delivery, patient safety and satisfaction, and clinical practice. HIS could be a relevant tool to inform hospital managers, support better management decisions in healthcare, and, consequently, increase efficiency. With the extensive developments in medical technology and the rise in patient expectations, a greater need for using HIS in the hospital has emerged, and in the twenty-first century, hospitals that lack HIS will be unable to compete with others.[2] The HIS structure is formed on the basis of each department's expectations of the computerized HIS; because this structure is unavoidably complex, it is referred to as the mother industry. Since the early 2000s, HIS has changed and evolved from an inconsistent system to a consistent one with an axis called patient electronic records. An ideal system should have many technical features, including the ability to identify medical trigger events, compliance with medical informatics standards, and the ability to use expert systems, as well as great flexibility in adapting to the culture and hospital workflow. HIS has many capabilities and added values, and it has the potential to revolutionize hospital services. Hence it is re-emphasized about the strategies which advocate appropriate application of Health information Systems (HIS) and communication technology for strengthening of data-sharing, analysis and utilization at all levels of hospital by bolstering data collection and unitization in a decentralized system as well as supported by research evidence.[3]

A HIS can be defined as a computerized or manual system (on paper) that is designed to meet all the information needs within a hospital. This includes different types of data (heterogeneous information), such as patient information, billing, finance and accounting, staffing, scheduling, pharmacy ordering, prescription handling, supplies, inventory, maintenance, order management, diagnostic reports related to laboratory, and patient monitoring, as well as providing decision support.[4]

Therefore, it is of fundamental importance that Health information systems (HIS) would make suggestions to build explanatory chain of information system problems, thus increasing the capacity of decision-making, since the information is essential to the decision, so that gives the manager knowledge of living conditions and health of the population.[5]

A health information management system (HIMS) has a set of components (technical, organizational, behavioral) and procedures "organized to generate information to improve health management decisions at all levels of the health system" and also for decision- making process in hospital. Engaging clinicians and other hospital personnel, including nurses, as well as providing strong institutional support, is critical to the successful implementation and operation of a HIMS in hospitals. These strategies have the potential to reduce significant resistance, reduce negative attitudes, and increase hospital staff acceptance of HIMS.[6]

Multiple studies have shown that using HIMS is difficult. This is due to the variety of computer interfaces and navigation options. It has been observed that some HIMS are not user friendly at all. This places an undue burden on hospital personnel who must learn the various HIMS operations. It is regarded as a barrier to HIMS acceptance.[7]

Initially, it is also resource intensive. This additional burden on hospital personnel fosters a negative attitude toward technology adoption. Although software behemoths like ORACLE, JAVA, and INFOSYS are gradually improving HIMS usability. In the future, the use of new technology such as voice recognition and voice assistants such as Google Assistant will drastically simplify HIS operations. Until now, designing user friendly software for HIMS has proven to be a significant challenge for IT professionals. As a result, it is critical to assess the level of HIMS acceptance among healthcare workers and investigate the determinants of HIMS that are impeding acceptance among all users.[8]

Every teaching institution has a critical role to play in the overall improvement of nursing officials' skills, attitudes, and knowledge of HIMS. Overall, little emphasis has been placed on research and development on this topic. Administrative research studies on this topic are still scarce.[9]

To the best of our knowledge, very few observational (in the technological domain) studies have been conducted with them worldwide. With this background, we intended to conduct this as an observational study to assess baseline acceptance of HIMS among healthcare workers (HCWs) working in a tertiary teaching hospital.

Hence, the present study was conducted to assess the acceptability level of HIS in decision making, as well as to improve quality of health care in teaching hospital of Visakhapatnam city.

MATERIALS AND METHODS

Study Design and Setting

An Institution-based mixed-method study using a mixed method *i.e.*, both quantitative and qualitative data collection methods was conducted at Dental Teaching Hospital of Visakhapatnam city for duration of 3 months.

Study Participants, Sample Size, and Sampling Procedures

The source of population were the health care workers (HCWs) working in Dental Teaching Hospital, who were managing administrative hospital staff, heading sub-process departments, and nurses.

Ethical considerations

This study was conducted as per the Declaration of Helsinki. Before data collection, we obtained an ethical clearance letter from the Institutional ethical committee [Ref No: ANIDS/IEC/2023001].

Inclusion criteria

HCWs who had been working in different managerial positions in the hospital for at least six months preceding the survey period were included in the present study.

Exclusion criteria

HCWs who were absent from their units/ departments, who did not give consent to participate, and who were seriously ill during the data collection period were excluded from the study.

The sample size for the present study was calculated using G power software.

Sample Size Determination

Sample size estimation is calculated using G power software

χ^2 tests - Goodness-of-fit tests: Contingency tables

Analysis	A priori: Compute required sample size
Input:	Effect size w = 0.4
α err prob	= 0.05
Power (1-β err prob)	= 0.95
Df	= 1
Output:	Non centrality parameter λ = 13.1200000
Critical χ^2	= 3.8414588
Total sample size	= 80
Actual power	= 0.9517627

The total sample for the present study was to 80

The total sample was arrived at 80 in which quantitative data was collected from 55 participants *i.e.*, questionnaire and remaining 25, qualitative data was used *i.e.*, face to face interview were conducted. Simple random sampling (SRS) method was used to select the samples in the hospital using the lottery method based on the list that was available in the human resource department of dental hospital for the qualitative and quantitative methods.

Data collection methods, tools, and procedures

Data which is primary in nature was collected using mixed method. Quantitative Data was collected using a pre-structured self-administered questionnaire which contained a total of 19 questions altogether which was pre tested and self-administered to 55 study participants.

Qualitative data was collected using face to face in-depth personal interview with a Kuppa swamy education score of 5 and below. The principal investigator facilitated the interview process. These meetings lasted 15 to 30 minutes and the participants were asked open questions about four main issues of facilitating and encouraging factors, inhibiting factors, the optimal existing factors to meet the needs.

Firstly, the questionnaire was prepared in English and then translated to Telugu (the local language), then back to English by the language experts to look for consistency of the questions. The questionnaire was pretested on 5% of the sample among managers working in Teaching Hospital, two weeks before the actual data collection. The questionnaire was reviewed and reformatted based on the pretest results. They were excluded from the final study

Data Processing and Analysis

Data was entered into Microsoft Excel and exported to SPSS version 26 for further analysis. Descriptive analyses like frequency distribution were computed for sociodemographic and other important variables were computed. A p-value < 0.05 with 95% confidence interval (CI) was used to see the strength of association between factors and the outcome variable. Finally, the results are presented using tables, charts and graph.

RESULTS

Quantitative data

Table 1 shows the demographic variables,

we found that most (38.40%) of our participants belonged to the age group of 25–35 years. Majority (45.60%) of them were females. Majority (69.70%) of them had bachelor's degree and 65% had work experience from 0- 5 years.

Table 2 shows the responses regarding acceptability of the questionnaire, regarding the accessibility of HIMS (69.09%) responded average, easy (14.54%), very difficult (9.09%).

Regarding the compatibility of HIMS, (63.5%) responded that HIMS was compatible and (9.09%) responded not compatible. Majority of the participants (52.72%) found HIMS system easy to use for everyone and (32.72%) found it not easy to use. A total of 52.72% of the participants found that the HIMS is average to work with. Most of our participants (47.27%) replied that they do not know about the error prevention mechanism. About (30.90%) of participants responded that there is an error prevention mechanism and (21.81%) replied that there is no error prevention mechanism. Most of our respondents answered that they were familiar with the HIMS. Nearly (34.54%) answered as average, (11.7%) answered as very familiar, and only (5.5%) of participants responded that they were not familiar with the system. A total of (63.63%) responded that the system was flexible.

Of the participants (27.27%) of the participants responded that the robustness of system was average, (70.09%) considered it to be just robust, while (1.81%) believed the system was not very robust. Of the participants, (9.09%) responded that this system never provides offline or online help. Among all participants, (69.09%) responded that HIMS always provide offline or online help/ guidance. Majority (49.09%) of the participants agreed that sometimes this HIMS induces stress, while (32.72%) agreed that this HIMS never induces stress while working. Regarding error prevention, (23.63%) of the participants ranked this system average, (76.36%) responded that it was trustful, and none responded that it was not trustful in respect to error prevention. Majority (69.69%) of the participants encountered system failure once a month, 16.36% encountered system failure once a week. Majority (81.81%) of the participants responded their system has a mechanism to detect user responsibility, (18.8%) responded that their system does not have a mechanism to detect user responsibility, and majority (81.81%) responded that there is a mechanism to detect user responsibility.

Majority (78.18%) of the participants did not want to add any new feature to the existing HIMS whereas (21.81) wanted to add new features.

Table 1: Demographic variables

Variables	Frequency (%)
Age (years)	
25-35	48 (38.40%)
36-45	28 (22.40%)
46-50	4 (3.20%)
Gender	
Male	23 (18.40%)
Female	57 (45.60%)
Education status (According to modified Kuppaswamy scale 2023)	
Professional degree (7)	0 (0.0%)
Graduate (6)	55 (68.75)
Intermediate/diploma (5)	16 (20%)
High school (4)	4 (5.0%)
Middle school (3)	4 (5.0%)
Primary school (2)	1 (1.25%)
Illiterate (1)	0 (0.0%)
Working experience (in years)	
0-5 years	52 (65%)
5-10 years	28 (35%)

Table 2: Acceptability of the questionnaire

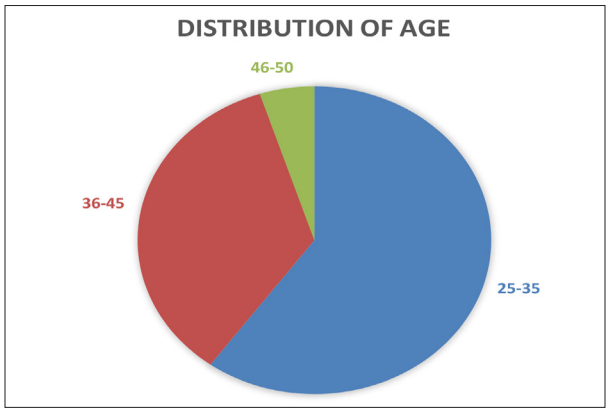
Questions	Responses	n=55, n (%)
Your HIMS system is easily accessible?	Very easy	0 (0.0%)
	Easy	8 (14.54%)
	Average	38 (69.09%)
	Difficult	4 (7.27%)
	Very difficult	5 (9.09%)
How much compatible is your HIMS system with the user's capability?	Very compatible	0 (0.0%)
	Compatible	35 (63.63%)
	Average	10 (18.8%)
	Least compatible	5 (9.09%)
	Not compatible	5 (9.09%)
Your system is easy to use for everyone?	Very easy	0 (0.0%)
	Easy	3 (5.45%)
	Average	29 (52.72%)
	Not easy	18 (32.72%)
	Don't know	5 (9.09%)
Does your system be efficient? (Quick and economical)	Very efficient	0 (0.0%)
	Efficient	28 (50.90%)
	Average	26 (47.27%)
	Not efficient	1 (1.81%)
	Worst	0 (0.0%)

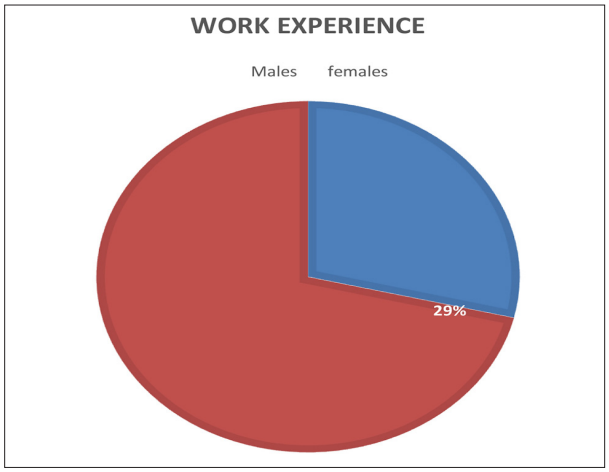
Table Cont...

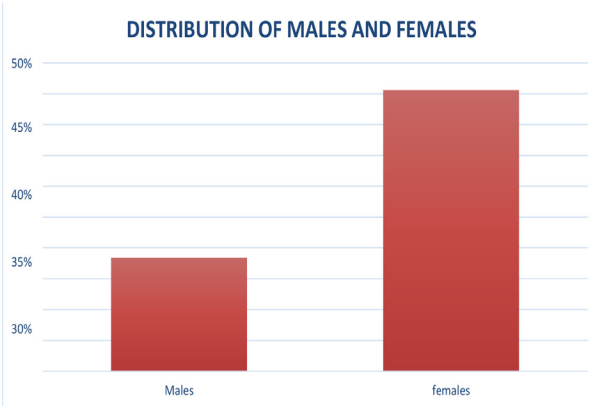
In your system has any error prevention mechanism?	Yes	17 (30.90%)
	No	12 (21.81%)
	Don't know	26 (47.27%)
How easy is error prevention in your system?	Very easy	0 (0.0%)
	Easy	35 (63.63%)
	Average	10 (18.8%)
	Not easy	5 (9.09%)
	Worst	5 (9.09%)
Did your system fulfil your expectations?	Very much	0 (0.0%)
	Fulfilled	25 (45.45%)
	Average	19 (34.54%)
	Not fulfilled	7 (12.72%)
	Worst	4 (7.27%)
Does your system is flexible i.e., you can adjust your system according to your needs?	Very flexible	0 (0.0%)
	Flexible	35 (63.63%)
	Average	19 (34.54%)
	Not flexible	9 (16.36%)
	Worst	2 (3.63%)
Is your system robust?	Very robust	0 (0.0%)
	Robust	39 (70.09%)
	Average	15 (27.27%)
	Not very robust	1 (1.81%)
	Worst	0 (0.0%)
Does your system provide online or offline help/guidance?	Always	0 (0.0%)
	Sometimes	22 (40.00%)
	Very frequent	16 (29.09%)
	Not at all	5 (9.09%)
	Worst	5 (9.09%)
Reply of participants in regard to feeling stressed while working on HIMS system:	Can't say	0 (0.0%)
	Not at all	18 (32.72%)
	Very frequent	10 (18.8%)
	Sometimes	27 (49.09%)
	Always	0 (0.0%)
How much you trust your system for preventing any error?	Very trustful	0 (0.0%)
	Trustful	42 (76.36%)
	Average	13 (23.63%)
	Not at all	0 (0.0%)
	Worst	0 (0.0%)
How frequently encounter system failure?	Never	0 (0.0%)
	Once in a year	8 (14.54%)
	Once in a month	38 (69.09%)
	Once in a week	9 (16.36%)
	Once in a day	0 (0.0%)
Is your system having a mechanism to detect user responsibility/ mistake?	Yes	45 (81.81%)
	No	10 (18.8%)
	Don't know	5 (9.09%)
Does your system have interlinking/ hyper linking facilities?	Yes	10 (18.8%)
	No	5 (9.09%)
	Don't know	35 (63.63%)
On a scale on 1-5, how much will you give to this system regarding acceptability?	5	0 (0.0%)
	4	37 (67.273%)
	3	10 (18.8%)
	2	8 (14.54%)
	1	0 (0.0%)
Do you want to add any new features to this existing HIMS?	Yes	12 (21.81%)
	No	43 (78.18)

HIMS = Hospital Information Management System

Table 2 shows the responses regarding acceptability of the questionnaire, regarding the accessibility of HIMS (69.09%) responded average, easy (14.54%), very difficult (9.09%). Workload problems, training with manpower finally the management, time related issues, level of education and data related problems were interviewed for 60 minutes using face to face interviews and their comments are written.







Qualitative data

The following were the main extracted axes of this study:

Workload problems, training with manpower finally the management, time related issues, level of education and data related problems. There were interviewee comments.

Q1. Work load

Do you believe that working with a computer is easier than entering data into a register?

One Participant responded that yes, it is easier to enter data into a computer as it was deemed easy thus decreasing the workload. Another participant responded that due to the

lack of number of the computers was less than the number of the users and lack of basic computer knowledge, so data was manually entered into the register. Computer was not used in all the departments and for all the matters.

Q2. Training

Do you believe that special training is required to work on a computer?

One Participant responded yes as due to their level of education, a special training was needed to reduce the work time. Another participant responded as the personnel were trained late, so the training time was not commensurate with the time of department's need and lack of monitoring the performance, special training wasn't required and decided to go with the manual entry.

Q3. Time related issues

Do you believe that entering data into software takes more time?

One Participant responded that yes due to low level of education and basic knowledge in the computer skills led them to respond in longer duration in data entry.

Q4. Level of education

Do you believe your level of education will help you understand and make your job easier?

Only participant responded as due to the level of primary school to diploma and responded that if their level of education were high, they could have understood the system and responded better. Other participant stated that due to the lack of appropriate course on training, their level of understanding of the software is less and decided to go with manual data entry.

Q5. Data related process

What is your opinion on data collection? Is it easy to extract data from software or data stored in a file system?

One Participant responded the data stored in software was easy as it was reliable and reduces workload also helps with longer duration but another participant responded that as they were habituated to the conventional data file system, manual data storage was more reliable as they can be stored for longer duration.

DISCUSSION

This study was conducted to assess the level of decision making using HIMS among personals involved a teaching dental hospital. According to our findings, majority of all participants had access to the HIMS system. This could be due to a variety of factors such as their job profiles, the distribution of their working places, differences in their experiences, the average accessibility is due to the limited availability of computers in the hospitals because this hospital is not fully computerized. Our current study had a wider scope as we included additional qualitative method to identify the root causes of average or difficult accessibility to HIMS. This is in line with study conducted by **Khalifa *et al.***[10] who found similar results (*i.e.*, lack of computer availability was the primary reason for suboptimal HIMS utilization).

In terms of human capability (knowledge and skills) and system compatibility, nearly half of those polled agreed that their system is compatible with their capability (knowledge and skills). It demonstrates that half of the participants were still unable (in terms of knowledge and skills) to operate the system. As a result, this is a major concern, so we must investigate the causes and resolve the issue. This is in line with a study conducted by **Alipour and Zarei**[11] in Iran which revealed that the level of computer knowledge and skills had more

dominant role in the acceptance of HIMS.

According to our findings, 50% of participants believe the HIMS system is moderately difficult to use. It is also a source of concern for us, as administrative staff and nurses are the backbone of any hospital and play an important role in HIMS. Accurate data entry is critical not only for patients but also to avoid future litigation. It is critical that the HIMS system be simple to use, as a complicated HIMS system can reduce the acceptance of HIMS system use. A similar finding was observed in an Iranian study, where it was discovered that image in using HIMS and perceived ease of use had a more positive impact.[11]

In terms of system efficiency, the majority of participants rated the existing HIMS system as average to efficient. In contrast to our findings, **Huryk *et al.***[12] discovered that the overall HIMS system was inefficient and caused user dissatisfaction in a systematic review.

Majority of the participants said they were aware of the HIMS error prevention mechanism. Almost one-third of the participants found it simple to correct the error. This is in line with a study done by **Huryk *et al.***[12]

The majority of the participants complained that every month they experienced system failure, which was upsets to them. In other studies, variables such as age, computer work experience, knowledge, and computer knowledge were found to be significantly related to user acceptance level.[13] However, only the education factor was found to be associated with user acceptance level in our study. As the graduates also had some difficulty using HIMS and participants who completed high school, diploma had difficulty in using HIMS. This could be because this is a dental hospital, attracting high-quality professionals can be challenging. Professionals who are highly educated and have a positive attitude and can effectively manage the HIMS system.

As for the qualitative part of the present study, research shows qualitative studies were dynamic, the obtained results went beyond training and included function's method, problems, and facilitating factors in using this progressing software system in the hospital. Because the goal of this system was to save data in a database at the same time, so that authorized users could access it when and where they needed it, with a structure tailored to the user's specific needs. The obtained results revealed that all of the major stages, namely saving, processing, and extracting information, had fundamental issues. In the present study, qualitative method was used to the personals who had an educational level from primary school to diploma, they entered the data manually using OP registers. Also, seasonal training classes must be held to receive feedback from new and old users and introduced them with HIMS.

In a study done by **Chen *et al.***[14] the study showed that system quality and information quality were important factors influencing perceived ease of use of HIS, while information quality and service quality were important factors influencing perceived usefulness of HIMS. They discovered that perceived usefulness and perceived ease of use had a significant impact on HIMS acceptance.

Wangenheim *et al.*[15] investigated user satisfaction in synchronous telemedicine and teleconsultation environments, and the collected data were quantified and statistically analyzed, revealing a clear perception of an improvement in service quality by both patients and healthcare professionals. The study's findings also revealed that both patients and healthcare professionals thought that introducing these new technologies was a positive step, even when they involved significant changes in the usual processes of primary care. This country does not meet the WHO's minimum workforce and bed density recommendations. A large proportion of the low-income population lacks access to quality healthcare. It is critical to use newer methods, such as m-Health, to make quality, affordable healthcare available to everyone. mHealth should be provided in tandem with other mServices such as mCare, mServices, mSurveillance, and mLearning. The success of mHealth will be determined by finding the right 'fit' between mHealth applications and healthcare needs; in other words, mHealth should be need-driven rather than technology-driven. HIMS proves to a digital revolution and efforts are made to do the same in various tertiary teaching hospitals.[16]

Moradipour *et al.*[17] indicated that an automated HIS can be a powerful tool helping managers with the process of hospital management and decision-making, leading to significantly improved hospital performance. Therefore, continuous training courses are beneficial in enhancing information quality and modern technology usage, which in turn improve the quality of services offered to patients and clients and make them less time- consuming. The present study was in contrast with a study done by **Tomas *et al.***[18] where more than 50% have rarely or never used the health information system to support decision-making.

Most managers do not use hospital information systems to support management-related decision-making in Angola. **Zahra *et al.***[19] constructed an instrument for data collection was a self-administered structured questionnaire based on ISSM, covering seven dimensions, which includes system quality, information quality, service quality, system use, usefulness, satisfaction, and net benefits. This method was developed to determine the HIS success rate based on users' viewpoints. This method allows for the comparison of HIS success rates in various hospitals.

Khalifa *et al.*[20] study done in a teaching hospital showed that HIS might frequently slow down the process of care delivery and increase the time spent by patients inside the hospital especially during slow performance and responsiveness phases. This is in contrast with the present study.

Putu Wuri Handayan *et al.*[21] conducted a study in a teaching hospital and emphasized to prepare a plan to restructure their network with adequate infrastructure, create IT blue print and policy, IT organization restructuring, IT staff competency development and build integrated HIS. They are in line with a study done by **Sakineh Saghaeiannejad-Isfahani *et al.***[22] obtained for the satisfaction with different kinds of HISs in use in the hospitals were using Kowsar System (old version) and Pouya Samaneh Diva system and showed the level of users' satisfaction with the systems in question was relatively good. **Javek *et al.***[23] showed that the hospital information systems in content aspect is in a good condition, but in terms of time and structure, proper solutions are needed to improve the effectiveness.

The present study showed the need for training procedures for HIMS, and these training programs should be appropriate as study done by **Khalil Kimiafar**[24] who showed some problems concerning information quality of HIS in Mashhad training hospitals. These problems include inappropriate information quality of the system and incompatibility with user needs which leads to decreased satisfaction of users towards the system.

In study done by **Cruz-Correia *et al.***[25] quality of hospital information systems (HISs) was assessed and results showed that existing audit trails (AT) do not have enough quality to guarantee traceability or be used in HIS improvement. Evidence from documents at hospitals and health centers indicated that proper use of electronic software

is not available, and this could lead to reduced productivity of the system documents and inefficient use of information in health records.[26]

Use of mobile hand held are also recommended by a study done by **Pandit *et al.***[27] for direct input of patient data into the HIMS.

Strengths

- The present study used a mixed method as both quantitative and qualitative method of data collection were used.
- This was the first study to be conducted in Vishakhapatnam city in a Dental Teaching Hospital.

Limitations

- Small sample size
- Since this study was conducted on one hospital, external validity would be limited in terms of generalizing the results and conclusions on other hospitals, especially if these were on a different healthcare level.

CONCLUSION

The study concluded that overall acceptance of HIMS was adequate, though there is still room for improvement. India requires mHealth to provide care and compensate for the country's already inadequate healthcare workforce and infrastructure. HIMS can be more effective in enhancing clinical staff members' and the healthcare system's performance by establishing a suitable organizational culture and giving therapists adequate training as significant users of these systems, and taking into account their HIS work requirements. Since implementation, execution, and Support for these systems is very expensive, it's crucial to consider the significance a budget for this area and take the necessary steps to ensure full acceptance of these systems documents in the legal gatherings. Overall, the participation of the higher management and the dedication of the end users is what may bring about a positive change and increase the utilization of HIMS ultimately aiming toward paperless operations in a teaching hospital.

Recommendations

- Training of the personals for HIMS may be conducted with the help of the IT department.
- User friendliness and new innovative methods for data entry, such as automated voice recognition, can improve the workload and enhance information quality.

- Increasing the availability of computers at the point of care.
- Equal opportunity for HIMS handling should be given to all personals on a rotation basis so that they become digitally empowered.
- HIMS system may be upgraded with modern facilities like hyperlinking, offline help like windows, software, hardware, etc.
- A 24 × 7 call centre can be incorporated in the IT department that can coordinate with the dental hospital to fix any shutdown problem.
- Implementation of mobile handheld devices: These can be in the form of electronic tabs given to the doctors in the OPD for digital prescriptions and to the doctors in the respective departments for input of patient data directly into the HIMS with installation directly into the tabs.

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Infection Control Modular Operation Theatre Model-Across-the-Globe to Ensure Highest Patient Safety Undergoing any Surgical Procedure

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Abstract

The Indian healthcare industry has grown dramatically in the last few years, particularly during the Covid-19. The extraordinary participation of the Government, as well as advancements in technology and the digitalization of healthcare services. In the Indian healthcare sector, a number of trends have emerged that are employing cutting-edge technology to simplify and improve the patient care experience.

Keyword: Infection Control; hygiene; Sterilization; Healthcare.

INTRODUCTION

Looking at the future, it is quite sure that the healthcare system of the country will be under pressure to enhance the efficiency of care and quality and search for new ways to use systems, data and distributed provider networks focused more on disease prevention and wellness. As a result, healthcare systems will require to be more integrated, while using technology to enhance healthcare system.

With emerging technology, the medical industry is demanding regular operation theatres to modular operation theaters in India. This is not without reason. Modular operation theaters have a concise design, integrated functionality, level of cleanliness that conventional operation theatres cannot match the standard. This is why more Hospitals and Healthcare institutions are investing in them with time.

Why modular operation theatre is required?

It is a compact and highly sterilized setup containing particular air filters (Filtration capacity – 0.25 – 0.5 microns) to control the airflow system in Operation Theatre. Some specific types of air conditioning for the safety of patient and Surgical Team.

Why hospitals prefer modular operation Theatre?

The main reason of modular operation theater for the patient safety and easier to install and the setup ensures that all the necessary surgical pieces of equipment are within an arm's reach. Every component of modular operation theatre is made from premium quality materials making them extremely durable.

Essential components that make operating a modular operation theatre easier

- Operation theatre central control panel
- Surgical scrubbing station
- X-Ray viewing screen

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- Ceiling mounted laminar flow with HEPA Filter
- OT control switches & control panel etc.

Today's scenario the Architecture of any hospital needs thorough planning, designing and analysis. The key purposes of establishing a Modular Operation Theater are efficiency, precision, safety and improved patient outcomes. Its main objective is to make the best use of available time and resources. There are many requirements from hermetic sealing, sound insulation, absolute flatness, vertical adjustment, ease of disassembly, non-inflammable materials, to adherence to all standard regulations like NABH (National Accreditation Board for Hospital and Healthcare Providers) & all.

Modular Operation Theatre helps in Stop the generation of bacteria, Standard occupancy of people and equipment load, Safety standards, Positive air pressure, Appropriate maintenance, Functional separation of spaces, Regulated traffic flow, Hygienic environment, Proper air ceiling system, Innovative medical workspaces, Special requirements for humidity and ambient temperature, Space for future devices and expansion, appropriate number of air change, helps in imaging and X-ray facilities during the ongoing operation thereby helping with quick analysis and informed decisions.

The safety of the patients is a top priority in the world of healthcare and with a well-equipped Modular Operating Theater a Doctors and team can quickly handle emergencies or complications.

In India, for setting up any Operation Theatre, operating rooms require and working like CSSD (Central Sterile Supply Department), Scrub zone, Pre & Post OT (Operation Theatre) Beds, is the most integrated function along with environment, safety of facilities, equipment, and devices. Besides, it should also ensure a comfortable working environment for the Surgeons, anesthesiology, OT (Operation Theatre) Nursing staffs, OT (Operation Theatre) Technicians etc.

Modular Operation Theatre is a breakthrough in the healthcare industry, satisfying all those conditions and incorporating all necessary functions. Over the last few decades Hospitals and medical institutions have been slowly shifting to Modular Operation Theatre to provide an operating environment with high work ability and solve or at least reduces the problem of infections and patient safety.

A Modular Operating Theatre is a prefabricated operating room built within the premises of a surgical department of a hospital. It is based on a modern concept where all innovative and advanced technology is available to provide a sterile working environment and highest quality care to patients and less post operative infections.

A Modular Operation Theatre broadly involves use of prefabricated wall panel and ceiling with laminar flow system, hermetically sealed doors, anti-static flooring and much more. These advancements, not commonly seen in conventional OTs (Operation Theatre) make modular Operation Theatre a much-preferred option for hospitals or any medical institutions.

India's competitive market, advantage lies in its large pool of well-trained medical professionals. India is also cost competitive compared to its peers in Asia and western countries. The cost of surgery in India is about one-tenth of that in the United States or Western Europe. The low cost of medical services has resulted in a rise in the country's medical tourism, attracting patients from across the world. Moreover, India has emerged as a hub for R & D (Research & Development) activities for international players due to its relatively low cost of clinical research and surgeries.

The Indian medical tourism **market was valued at US$ 2.89 billion in 2020 and is expected to reach US$ 13.42 billion by 2026.** According to India Tourism Statistics at a Glance 2020 report, close to 697,300 foreign tourists came for medical treatment in India in FY19. India has been ranked 10th in the Medical Tourism Index (MTI) for 2020-21 out of 46 destinations by the Medical Tourism Association.

The e-health market size is estimated to reach US$ 10.6 billion by 2025.

Fig. 1: Modular Operation Theatre

Fig. 2: Modular Operation Theatre

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Standard journal article

[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006; 35: 540-7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O,

Kidd EAM, editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ 20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

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