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A Dire Need to Incorporate Hospital Information System in Paramedics' Curriculum: Evidence from Private Hospitals' Paramedics of Delhi-NCR, India

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Abstract

Background: Hospital Information System (HIS) is used to improve intra-organizational communication and retrieve digital copies of medical records. In India, approximately 300,000 paramedics passed out annually from 8500 institutes, without HIS knowledge. In lack of trained paramedics, and unseen expenditures to train them, it is required to understand what is needed to augment efficiency in hospitals for generating revenue. **Objective:** The current paper aimed to bring attention about how HIS user comfortability is influenced through work experience in years, personal usage of computer for self-work, and hospital size (bed strength) where paramedic works. This is essential to improve work efficiency and enhance the quality of services. **Methods :** A cross-sectional study with 505 paramedical staff through snowball sampling was interviewed online through a pre-tested schedule in Delhi-NCR. The sample size was calculated using Cochran's formula, considering the 50.0% prevalence of untrained paramedical on HIS. Correlation, regression, and Pareto analysis were conducted in SPSS (version-22.0). **Findings:** Although HIS awareness is high, 97% respondent did not receive any kind of computer education. 75% of them owned it through on-job experience and 96% of the respondent agreed that HIS training should be inculcated in academics. The correlation and regression association were found positive between "hospital work experience" ($R^2 = 0.72$), "numbers of hours computer used in a week" ($R^2 = 0.92$) with "average comfortability score of using HIS". **Novelty:** This paper brings forth the idea of understanding "average HIS user comfortability score" and "prevalence of HIS training in paramedic academic". The full potential of HIS to generate business is underutilized in India. This could be achieved by modifying existing paramedic curriculum. Currently, majority of problems associated with the HIS use is rectified by swift IT support, and intensified on-job-training, however it could be mitigated by intervention in the form of mandating HIS training in academic.

1 Introduction

The Healthcare system of a nation could be considered as a most vital indicator of its growth and development. As we are in the era of Information-Technology (IT) and digitalization, the impact of technological advancement is very evident in many fields, hospitals are no exception. HIS is a comprehensive software that facilitates better coordination between different groups of hospital staff, by reducing communication errors. Further, it enables an augmented pace of information exchange by using digitalized storage, retrieval and sharing of data regarding administrative, clinical, and diagnostic functioning. In developed countries, the utilization of HIS has increased exponentially, whereas in India (and other developing Asian nations), the utilization pattern indicates the nascent stage of HIS. HIS provides the tools and functionalities but requires data entered in a prescribed and timely manner from hospital staff, such as vitals charting, medications, clinical notes etc[1], which may be perceived as an additional workload by clinicians, if not agile in HIS usage[2]. In last two decades, proper documentation of medical records became a key issue that impacts the functional accuracy of healthcare organisation along with gathering of data for epidemiological research[3]. High-quality documentation has become an integral part of big corporate hospital chains in developing nations like India. This has benefitted not only the national citizens, but also international patients. This is ultimately responsible for augmenting revenue from international medical tourism and establishing India as a hub of medical tourism[4,5]. This may be attributed to the gradually changing image of Indian private hospitals from 'ivory towers of disease & infection' to 'quality conscious organizations'[6,7].

In light of the COVID-19 outbreak, researchers have investigated various modes of viral transmission within the healthcare facility and suggested wide range of interventions. Recent researchers argue, in the covid era that HIS's potential of making hospital paperless is one of its much strength[8]. HIS could aid in preventing viral transmission and treatment by linking to telemedicine technologies, and synching with AI (Artificial Intelligence) based emergency case detection system[9].

Studies have found high chances of the Severe Acute Respiratory Syndrome Corona Virus-2 (SARS-CoV-2, also known as COVID-19) transmission by paper-based documentation in hospitals[10]. Studies have also reported that paramedics are at high risk for COVID-19 transmission while handling infected paper and files[11]. However, in developed countries, the Electronic Medical Record (EMR) module of HIS has been used by various hospitals to interrupt transmission. Nevertheless, HIS implementation is a complex and multifaceted process that depends on various factors. Researchers have identified computer-skilled personnel as one of the most crucial factors and a prevalent challenge and generating patient satisfaction and brining quality in business[12,13]. Recent researchers have also underscored interoperability of HIS with other wireless technologies as a potential as well as barrier in the digitalization era[14]. Further, successful implementation of HIS is positively associated with the attitude of HIS end-users (paramedic staff), intra-organizational environment, prior computer literacy, appropriate user interface and familiarity with HIS[15,16]. Researchers have argued that transitioning into a job for a paramedic student is a stressful task[17]. The reason outlined were the lack of confidence in fresh paramedic graduates and lack of practical experience[18,19]. Recent research suggests, in case of any new technology adoption in a healthcare organization, addressing the concerns of staff and developing correct perception in paramedics is of high importance[16,19]. In low- and middle-income countries like India, where approximately 300,000 paramedics passed

out annually from 8500 paramedic institutes are not exposed to the HIS[20,21]. The curriculum of paramedic programs of these institutes is governed by the Indian Nursing Council, Government of India, who did not orient the future professionals toward the immediate need of the hospitals. These practices adversely affect the overall quality of the program and create a barrier in future career progression of paramedical students. The paramedic curriculum could be reformed with value-added training programs[22]. The researchers argue to shift the didactic method to a more practical method of education, which can stimulate paramedic workplace conditions[23].

Hence, it could be highlighted from earlier research and discussion that analysing the impact and potential of HIS on workflow and awareness level of paramedics needs to be researched. And in context to India, very few good qualities of research have been done to identify the factors that influence HIS user comfortability and the prevalence of HIS training in academic programs. So, this paper aimed to understand the association and its effect on the performance of paramedical staffs in hospital settings of Delhi-Near Capital Region (NCR). Further, to meet the objective of this paper, the authors consider three hypothesis assumptions i.e., (i) The average HIS user comfortability is statistically associated with the work experience of the paramedic, (ii) The average HIS user comfortability is statistically associated with the number of beds in the hospital where paramedical staff is currently working, and (iii) The average HIS user comfortability is statistically associated with the computer usage by the paramedic for personal use. In a more comprehensive way, the study tried to bridge HIS related knowledge gaps by analysing the variables and assessing their impact on HIS user comfortability. This also attempts to identify the most common issue and technical challenge associated with HIS and find out the opinion of paramedics about inclusion of HIS and related medical software training in the course, in order to equip the students with computer skills and making them familiar with the HIS usage.

2 Methodology

A cross-sectional descriptive study design was executed with variables identified from literature, in Delhi-NCR region of India. In the lack of sufficient literature, 384 Sample Size was estimated using the Cochran formula, where prevalence was assumed to be 50% for knowledge about HIS (confidence level 95%). As the information were gathered from online sources, to minimise the error and biasness more respondents (35% more) were interviewed. However, due to COVID-19 scenario, only 543 respondents revert to us with information among whom, 38 schedules were rejected due to incomplete information. The data were collected from 15th May to 15th July 2021 through a pre-tested structured schedule. The schedule consisting of two sections, first section was devoted to demographic profile followed by questions on awareness about the HIS, most observed problem, opinion about HIS training, perception towards HIS utility in making hospital paperless and controlling of fomite borne Hospital Acquired Infection (HAI), from touching papers etc. Respondent comfortability of using HIS was captured by using a Likert Scale of 5 points. As inclusion criteria, following points were considered such as (i) Respondent must be working as a paramedical staff in a private hospital with in-patient services for last 6 months in Delhi-NCR; (ii) Respondent must have formal paramedic education in their respective field of work; (iii) Age of respondent should be at least 18 years; (iv) Only completely filled questionnaire are included in the study. Respondent must be able to understand Hindi or English language. Snowball sampling method was used to contact the respondents. For analysis, IBM-SPSS® (version 22.0.0.0) was used. Pearson's correlation coefficient (r) was calculated to find the association between variables followed by linear regression. The score was generated for technical challenges faced by the respondents through Pareto analysis.

3 Findings

The current findings are summarised in two specific segments: (i) respondent's profile, perception of respondents towards impact of HIS, and (ii) comfortability and acceptability of HIS.

3.1 General profile of the respondents

Out of the 543 respondents, the study received 505 responses which satisfy the criteria to reduce biases. The analysis revealed that 47% of the respondents were working as nurse followed by 16% laboratory technician and 11% pharmacist. The awareness about HIS was reported to be among 84% of the respondent however, 97% respondent did not receive any kind of computer education during their professional course. Contrary to high proportion of respondents having basic awareness about HIS and its utilisation in hospital sector, the study analysis revealed that only 75% of respondents owned it through on-job experience of using HIS. Further, it shows that 96% of respondents had not received any training during their professional course although they agreed that HIS (or related medical software) training should be incorporated into the curriculum of paramedic education. However, the opinion differed by category of respondent such as 99% for dietician, 93% of pharmacist and 92% operation theatre

technician agreed. In modern digital era of technology now, everything such as paperwork has been replaced by electronic documents. The same opinion was perceived by 89%respondents that HIS would be reducing the workload burden in the hospitals. Followed to this, 81% of respondents who experienced HIS agreed that digitalised documentation instead of paper-based documentation assists in preventing hospital-acquired and COVID-19 infection also.

The study tried to understand the distribution of opinion among the respondents by bed size of the hospitals. It unveiled that 31% of respondents working in small hospitals i.e., up to 50 beds agreed that HIS did speed up the communication process and more efficient, however, in case of medium to larger hospitals, the same opinion was reported to be high. This may be due to the propensity of bigger hospitals (over 50 beds) towards HIS implementation is more (Figure 1)
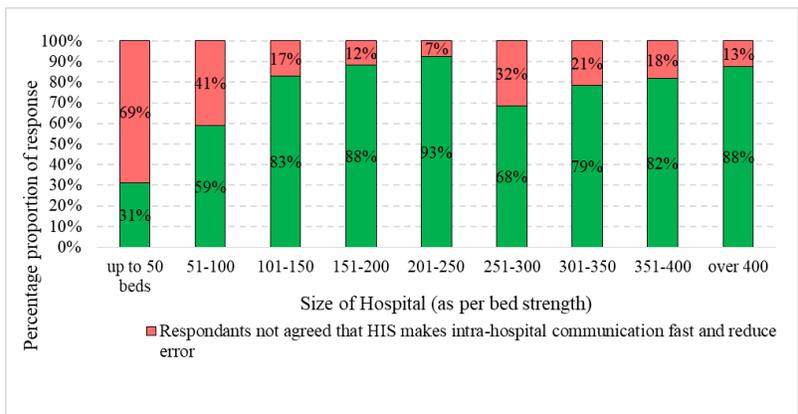

Fig 1. Depicting perception of respondents of different hospitals towards the impact of HIS on intra-organizational communication

3.2 Comfortability score and acceptability of HIS

For providing quality services and to generate business in the hospitals, HIS always plays an important role as it supports a decision-making system. Many research articles highlighted that HIS leads to customer satisfaction and quick decision for the patients and attendants on what to do and what not to do. However, the significance has not been done for a diversified opinion of working professionals such as paramedical staff. To get the experience of the studied respondents, bivariate analysis with Likert scale was done and summarized in Figure 2. It revealed that majority of respondents who were working as pharmacist are feeling comfortable in using HIS with an average score of 3.6 out of 5, followed by pathology and radiology respondents with an average score of 3.3 and 3.2, respectively. Clinical paramedic respondents i.e., nurses, physiotherapist, and operation theatre technician, were reported to be lower comfortability scores compared to non-clinical paramedics i.e., Central Sterile Supply Department (CSSD) staff with least average comfortability score Figure 2.
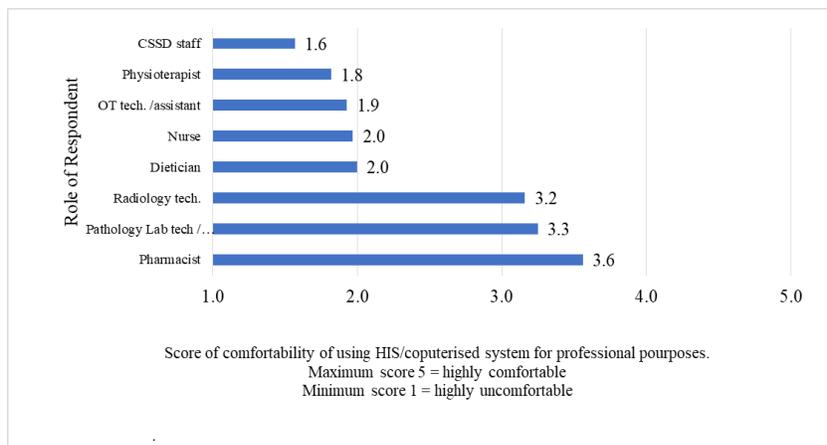

Fig 2. Average of comfortability score of subgroups of respondents

Further to understand whether any kind of association is existing between the studied variables such as average comfortability score and total working experience of the respondent, where comfortability was considered as dependent variable. Correlation and linear regression analysis was carried out from the respondent data to test the hypothesis which shows that there is a significant difference exists between the working experience of the respondent in the hospital and average comfortability score. In other words, the correlation analysis given in the Figure 3 concludes that if the experience of a person is more in terms of work in different hospital, the professional could feel comfortable to use the HIS in the hospital. This means there is a positive association exists between "hospital work experience in years" and "average comfortability score of using HIS" Figure 3.
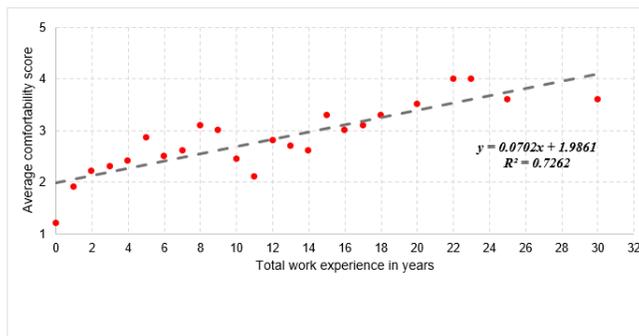

Fig 3. Linear regression analysis - Average comfortability score of using HIS (out of 5) vs Work experience of paramedic in years

The correlation was also tested further to understand whether there exist an association between the variables i.e., "the sizes of hospital in which respondent is currently working" and "average comfortability score of using HIS" or not. The analysis shows that no association exists between the two studied variables as the R^2 value is less than 0.7 ($R^2 = 0.22$). The study also analysed that 76% of the respondents have experience of using computer in their daily life. To understand whether any association exists between "uses of personal computer for certain hours" and "comfortability in using HIS was also tested by correlation" correlation was once again analysed. The findings in Figure 4 further shows that there is a high correlation exists between the two variables i.e., "numbers of hour laptop and computer used in a week" and "average comfortability score of using HIS" ($R^2=0.92$).
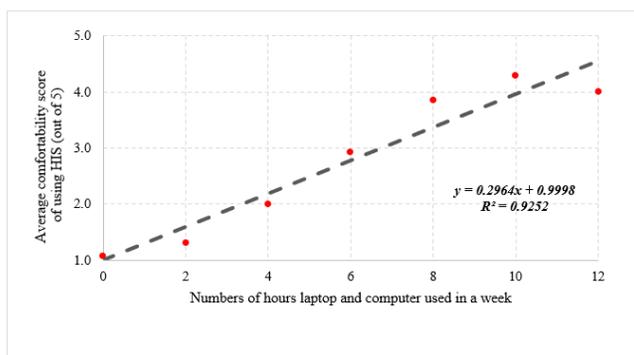

Fig 4. Linear regression analysis - Average comfortability score of using HIS (out of 5) vs Numbers of hours laptop and computer used in a week

Implementation of HIS is a huge challenge in hospital settings where staffs are recruited form various backgrounds. But nowadays looking at the need of the hour, training skills have been adopted by many hospitals including corporates, and they incurred a huge amount of indirect cost in terms of money and time which they could save, if get a trained paramedical staff. In current study, respondents were asked to select one or more challenges they faced from the listed issues and was reported that lack of training of staffs on HIS is key problem in implementing HIS in the hospitals as per the respondent. The other reasons are lack of swift technical support from software developer team or hospital's IT department is the most prevalent technical problem faced by respondents (selected by 63%) followed by a glitch in the software (selected by 51%). It means due to lack of training,

the professionals get challenges such as typing error, wrong data entry and double data entry etc. during operating the HIS. This leads to serious degradation in quality of reporting and further quality care of services. To understand this, Pareto analysis was done which showed that the 3 key factors which account for 80% of the problems were (i) Lack of technical support from the software-developer team or IT department (ii) Glitch in HIS Software, and (iii) Complicated User Interface (Figure 5). This means if the three mentioned problems will be resolved at hospital setting, then HIS will be easily implemented and adopted bringing patient satisfaction.
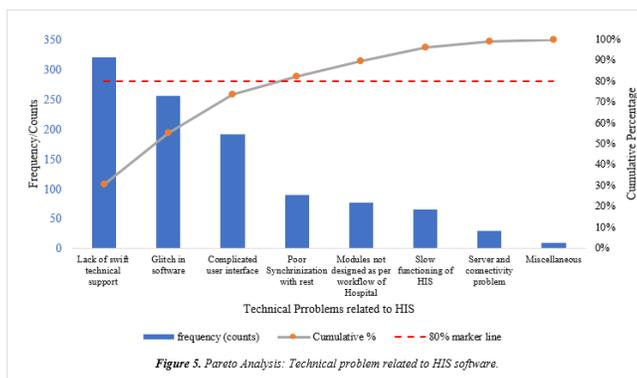

Figure 5. Pareto Analysis: Technical problem related to HIS software.

Fig 5. Pareto Analysis: Technical problem related toHIS software

4 Discussion

In India, private healthcare service providers have taken up a significant healthcare load. Many of the hospitals are recruiting paramedical staff to operate the hospitals more efficiently along with doctors. In the current study, the data also shows that the nursing staff category contributes majority of paramedics working in private hospitals in study area. Further to note that the usage of HIS by paramedics in smaller hospital setting is relatively low, this may be due to many reasons, namely, absence of HIS in the hospitals and maintaining paper-record, lack of awareness in hospital management, shortage of resources, lack of strict HIS implementation policy etc. Whereas in medium to large-sized private hospitals, there is more awareness as well as utilization of HIS by paramedics. Benefits in the form of fast and error-free communication may be motivating factors for bigger hospitals to adopt HIS. Further, the findings conclude that work experience of a paramedic is also considered as a crucial factor, as it increases the awareness and openness towards the HIS utilization increase, which ultimately leads to easy adoption and higher HIS usage comfortability.

Further, the study envisaged that average comfortability scores of clinical paramedics such as nursing & physiotherapist are lesser as compared to non-clinical paramedics. The reason behind could be excess clinical workload, or the feeling of clinical work could get hampered if data entry is done on computer during clinical activities. Contrary to impact of work experience of respondent on average comfortability score, results reveal that the comfortability of using of HIS by a paramedic is not governed by the hospital size (bed strength) in which they are working. Regardless of the size of hospital, the complexity of the HIS software remains the same. The underlying reason may be the number of modules in HIS depends on the number of functionalities of hospital, which remains unaffected by the number of beds.

5 Conclusions and Suggestions

Health is valuable to all of us. And the growing business of hospitals reflects that 86% of the clients are ready to pay for better healthcare services. However, 51% expressed their dissatisfaction after encountering a bad experience[24]. So, to meet the expectation of patients, equip the hospital with quality staff and HIS, there is a demand by paramedics to incorporate HIS practical training during academics too. Further, it is evident that the respondent's comfortability of using HIS increases with an increase in work experience and the usage of computers for personal by the paramedics. This could be due to gained familiarity with the basic computer operations. Further, as the paramedics gain more work experience, the realization of HIS benefits increases. The majority of problems associated with the HIS use could be rectified by the swift response from the IT team and intensified on-job HIS training. Therefore, the policies regarding HIS training should be uniform for all hospitals. Researchers argue that using uniform HIS and EMR will lead to significant cost saving for patients as well as healthcare service providers[25].

Second, changes in academic curriculum and development of one standardized HIS may take a longer time to happen. However, the situation could be mitigated by providing role-specific HIS module training either by the academic institute or hospital management before on-job placement of newly recruited paramedics in order to develop required awareness, familiarity and skill. Furthermore, hospital administrators should give high priority to strengthening of existing technical support system to resolve the majority of technical issues. In the COVID-19 era, there is a need of making hospitals paperless, more than ever. In the lack of proper policy, this is not possible in a country like India, where diversified hospitals are located. The situation could be mitigated by government intervention in the form of mandating the HIS training during paramedic academic programs. Software developers, government, and researchers should try to come up with one standardized model (user interface wise) which will help in making the training process universal, reduce the stress of learning new HIS software while changing jobs, and reduce resources required for training recruited paramedics. This required further research. This will also reduce the effort of learning new HIS in-case job switching from one hospital to another. The full potential of HIS in a developing nation like India is yet to be utilized. HIS could counter the COVID-19 pandemic on multiple fronts, from prevention of viral transmission to swift information sharing and assisting other digital health technologies.

6 Novelty

This study brings forth the idea of "average HIS user comfortability score" and the prevalence of HIS training in paramedic academic programs. The present study attempts to identify the most common issue and technical challenges associated with HIS and find out the opinion of paramedics about the inclusion of HIS and related medical software training, to equip the paramedics with computer skills and make them familiar with the HIS usage. The present study also shed light on the perception of paramedic staff towards the potential of HIS to limit the HAI including COVID-19 transmission, which is the need of an hour.

7 Limitations of Study

Due to lack of resources and limited time, this study is conducted in a selected region of India with snowball sampling. Further the ongoing COVID-19 pandemic may have influenced the human nature of subjectivity, and biasness while filling the schedule.

8 Ethical Declaration

No information was recorded that discloses the respondent's identity in any way. The respondents were informed that they had the freedom to respond or refuse to be a part of the survey or could withdraw anytime. All the participating paramedics were informed that their responses shall be kept strictly confidential and will not be shared with anyone.

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