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# Assessment of Human Factors & Ergonomics effecting Patient Safety Culture in a Tertiary Healthcare setting of a South Asian country

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**ABSTRACT**

***Introduction:***
The Patient Safety (PS) movement dates back to the 1950s, but in recent decades has caught up in swift momentum and is also influencing the Indian healthcare scenario - a lot of work has been done on the global scenario and we are just catching up.

***Materials and Methods:***
This baseline assessment assesses the current state of Human Factors & Ergonomics w.r.t. Patient Safety Culture (PSC) in a tertiary healthcare institution of Northern India within a study population of doctors (faculty & resident), nursing staff (graduates & undergraduates), and technicians - a first of its kind for the region. The overall response rate was obtained on the (customized & validated) Hospital Survey on Patient Safety Culture (HSOPSC) toolkit.

***Results:***
The overall response rate came to 75.7% and the composite Patient Safety Culture score was 46.35% (with internal variations).

***Conclusion:***
This calls for introspection to lift the overall standards of PS and PSC and to build further upon them.

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## Introduction

Patient Safety (PS), a concept whose history dates back to thousands of years and finds subtle mention in texts of ancient civilizations, called for Homo sapiens to act upon others in 'good faith'. The PS movement dates back to the 1950s, but it caught momentum in the 1980s when physicians and surgeons conscientiously thought of bringing it to the mainstream. Later, To Err is Human by Institute of Medicine, USA in the 1999 and An Organization with a Memory; produced by the UK Government's, Chief Medical Officer in 2000 were the final nails in the coffin, decrypting our Bronze Age presumptions and practices.

The spirit began in October 2004, when the World Health Organization (WHO) launched a PS program in response to a World Health Assembly Resolution (2002) and the establishment of the World Alliance on Patient Safety (WAPS) underlined the importance of PS as a global healthcare issue 1. Since then WHO has come up with PS Solutions 2 and JCI has been updating the NPSG 3 keeping in sync with the needs of the time. Despite progress in the past, since the release of To Err is Human, improving PS in healthcare remains a significant public health issue. The history of safety policies, research, and development has revealed that this issue is more complex than initially perceived and is pertinent to all healthcare settings. Solutions, therefore, must be approached at the systems level and supplemented with a change in safety culture. However, the successful application depends heavily on solid leadership and vigilance4.

India began working for Safer Care and was also a co-signatory to WAPS in 2004. In 2005, the National Board for Hospitals & Healthcare (NABH) a unique Government - Industry - Academia collaboration accreditation system advocating the same, was established. To synergize, the silos National Patient Safety Implementation Framework (2018-2025) was given. It speaks of PS being considered by the Government of India as a function of Universal Health Coverage (UHC) 5 which is the fulcrum of the various healthcare cum social welfare schemes, currently running or being re-engineered.

There are two different aspects to PS & its culture: First, the apparent prevention of unnecessary harm to the patients, and secondly, the detrimental effect on caregivers 6 in terms of motivation, reputation, and financial loss secondary to litigation, compounding issues for healthcare organizations as a whole. As hospitals and doctors are simultaneously under several laws 7 with an increasing proactive populace and judiciary, they can't falter and sleep as quickly as it used to earlier. The growing cost of healthcare coupled with accessibly and affordability for an average man, varied statues of demographics across the nation, newer diagnostic and treatment modalities, and technology-led awareness taking patient expectations to newer horizons all oscillating in a world of medical tourism are challenges to the healthcare service sector faces day in and out.

The coming in of new players like technology giants has already revolutionized the medical science ecosystem with telemedicine, robots, and artificial intelligence revolutionizing the way it used to sense healthcare.

Hence, this study, a rare of its kind, in Northern India, is going to suggest ways to modulate Human Factors (and Ergonomics) to augment the current Patient Safety Culture (PSC).

### Aim and Objectives:

This study aimed as "A baseline study to assess the current status of Human Factors & Ergonomics vis-à-vis Patient Safety Culture, using benchmark (WHO Patient Safety Multi-Professional Curriculum Guide tool),to suggest measures to augment the Patient Safety Culture in pre-identified patient care areas of a Tertiary Healthcare Teaching Institute in Northern India." The objectives of this study were: (1). To design & validate an assessment toolkit based on the WHO Patient Safety Multi-Professional Curriculum Guide Tool (MPCGT). (2). To ascertain the current status of Human Factors & Ergonomics vis-à-vis Patient Safety Culture in pre-identified patient care areas. (3). To suggest measures (based on a

prior assessment), if any, so as to augment the Patient Safety Culture in pre-identified patient care areas.

**Review of Literature**

The review of literature based on systematic screening of Electronic databases (PubMed, Google Scholar, Google Books) with search strings "human factors" or "ergonomics" or "patient safety" or "patient safety" AND "culture" [All Fields] or "healthcare" AND "culture" [All Fields] which is subdivided into two main parts:

**1.2. (A) Global Landscape:**

Prior-publication of "To Err is Human" by Institute of Medicine - (before 1999 A.D.):
Modern medicine, however, has introduced potent procedures than cannot constantly be harmlessly used8. In 1991, the Harvard Study stated the outcomes of a population-based study of iatrogenic injury in hospitalized patients in the year 1984 in New York. Nearly 4% of patients sustained an injury that extended their hospital stay or resulted in a measurable disability of which 14% were fatal. Indeed, injuries are the 'tip of the iceberg' of the problem of errors, since most errors do not result in patient injury9.

Given the multifaceted nature of the healthcare profession and the multitude of interventions each patient receives, a high error rate isn't surprising. The patients in the intensive-care unit were recipients of an average of 178 'activities' per day. The 1.7 errors per day indicate that the hospital was functioning at 99% proficiency. As W. E. Deming says, "If they had ensured 99.9% proficiency, it would have 2 risky aircraft landings per day at O'Hare"9.

Developments in modern medicine have provided doctors with more: (i) knowledge of the human body (ii) accurate methods of diagnosis and (iii) sophisticated technology to help in examining and monitoring the sick. The technology seems so exact that error becomes almost unthinkable; all of that means more power to intervene in the disease process. Contemporary medicine, with invasive investigations and potentially lethal medications, has given medics the power to do further damage and they can't discern how to handle them once they occur10. Role models in the medical ecosystem reinforce 'the notion of infallibility'. A new physician/surgeon's mentors are largely doyens in their specialties, and authorities don't err. Therefore, this need to be infallible builds a robust force to be intellectual deceit 9. A moment's consideration shows that errors in the air and operating theater are too mutual11. Scheming for safety has institutionalized a number of distinctive characteristics in the aviation industry which, with apt alteration, can prove valuable in improving hospital safety 9.

Post-publication of "To Err is Human" by Institute of Medicine - (1999 A.D. and onwards):
It is common to analyze Adverse Events (AE) by Root Cause Analysis (RCA) teams to address these issues. These teams look further than accusing persons and systematic vulnerabilities. In fact, errors and violations are only the jumping-off points to a different kind of journey, not the end game12.

Identifying and describing AE characteristics is the essential initial first step to improving PS. The estimated proportion of hospitalized AE has ranged from 3.8% to 16.6% across countries13. Within healthcare, there have been various attempts to analyze AE from a Human Factors (HF) perspective. The most widely known approach is the London Protocol14. Enhancing the safety of patients includes three complementary actions: preventing AE, making them visible, and mitigating their effects when they occur 15. A safety culture exists when each individual healthcare worker assumes an active role in error prevention supported by organizational leadership and management. Assessing PSC is an important intervention in itself and can provide useful information at the beginning of the improvement 16.

Human Factors & Ergonomics (HFE) is a science and a practice discipline 17. The lack of consideration for HFE in the design of a system is now recognized as a critical barrier to the success of Health Information Technology (HIT). As a result, the Institute of Medicine (IoM) has called, in a 2012 report, for more effective integration of HFE approaches…with HIT in clinical settings 18.

In March 2017, the Joint Commission underlined the importance of a culture of safety 19 by dedicating a sentinel event alert to this topic 20.

To promote a culture of safety, the Joint Commission requires its accredited institutions to participate biannually in a Safety Attitude Questionnaire 21 in order to remain accredited. The importance of culture and its change needs to be brought to the forefront, rather than taking a backseat to other safety activities 22.

### 1.2. (B) Indian Landscape:

The National Accreditation Board for Hospitals and Healthcare Providers (NABH)23 standards comprise 10 chapters with 102 standards and 636 objective elements. Recognizing the need to address the Adverse Drug Event (ADE), the Government of India initiated the National Pharmacovigilance Programme in early 2005, which was restarted as the Pharmacovigilance Programme for India (PvPI) operational from mid-2010.

The NABH guidebook 23 duly mentions and incorporates the concept of PS and patient-centered care elements. PSC assessments are required by international accreditation organizations since healthcare systems traditionally function as professionalized bureaucracies - unsafe cultures in themselves 23.

Although inadequate resources are likely a substantial challenge to the improvement of PS in India, other safety barriers to PS in healthcare in the South East Asian Region of WHO are 16,25,26:

1. Limited resources, poor healthcare infrastructure, and equipment
2. Hospital beds may be located in structures originally built for other purposes.
3. Lack of safety culture and attitudes that overlook basic safety rules for patients and healthcare professionals
4. Healthcare professionals are reluctant to register or talk about AE
5. Recently, the educated population has begun to challenge medical authority and the doctor–patient relationship is becoming more confrontational.
6. Understaffing and lack of a skilled workforce ensure that an overburdened
7. Regulation of the private health sector, including the pharmaceutical and medical device manufacturing industries, is a major challenge. Evidence indicates that the risk of getting HAI is 2–20 times greater in emerging economies. Little data is available about nationwide surveillance of HAI and data is mostly subjective. According to a recent review, Surgical Site Infection (SSI) is the most surveyed type of infection in Low and Middle-Income Countries (LMIC) with incidence rates ranging from 1.2 to 23.6 per 100 surgical procedures and a pooled incidence of 11.8%. By contrast, SSI rates vary between 1.2 - 5.2% in developed countries. According to an India Clinical Epidemiology Network (India CLEN) study, on average, in India, each person received 5.8 injections per year and nearly two-thirds of the injections being administered in an unsafe manner2626. Based on the electronic screening of the Meta database, it found only 3 published studies that were done in the Southern part of India. A study in 3 tertiary care institutions in metropolitan cities of India showed no variation, as observed in the PS score among the study hospitals27. A similar cross-sectional survey of safety attitudes in 4 private hospitals in Gujarat revealed promising results28.

## Materials and Methods

The duration of this study (analytical, cross-sectional, and prospective) at Study Setting (SS) was 13 months (April 2019-April 2020) whereby the first 12 months were for tool design and data acquisition. The study areas comprised Accident and Emergency Department, Investigation Services (Sample Collection Centre, Departments of Microbiology, Pathology, Blood Bank - Transfusion Medicine, Radio-diagnosis and Nuclear Medicine), Medical Wards (Neonatology and Gastroenterology), Surgical Wards (Endocrine Surgery and Gastro-surgery), Intensive Care Units, Operation Theater and Miscellaneous (Final year B. Sc. Nursing Students, Hospital Administration). The study sample comprised doctors (faculty and residents), nursing staff, technicians, and nursing students. Stratified random sampling proportional to size was used to recruit study samples. The total study population in

the predetermined study areas came to be 783 (excluding the study guides & principal investigator). The minimum recommended sample size calculated using Cochran's formula with a 95% confidence level and 5% margin of error; came out to be 259. In light of anticipated attrition of recruited samples during the study and the sample size of the study was 300 with category-wise (using the unitary method) split duly incorporated (Table 1) in proportion to their current size with inter-alia variations within. As human capital, will take only real numbers, any decimal number ≤ 5, rounded off to the nearest lower value and vice versa.

The inclusion criteria for recruited samples were those who had worked in the study area for a minimum of 180 working days. Automatic exclusion for healthcare staff on leave or who wished to opt out at any stage of this study. The data was acquired in semi-quantitative (demographics) and quantitative using customized and pre-validated toolkit amenable to Indian settings duly approved from AHRQ30 in the form of 26 positively worded and 18 negatively worded statements to obtain composite PSC (cPSC) score. Three modalities of data collection are - hard copy, whatsapp, or email of the investigator. The contact number of the investigator shared to clear doubts if any aspect of the question was being asked forth. The data was pre-processed (and excluded, if any deficiency) and later analyzed using SPSS 26.0. The ethical codes as followed for the study were: (1) the participation of recruited samples was purely voluntary for the recruited sample with an option to exit at any phase of the study; (2) data of individual responses - deliberately kept anonymous, confidential (no mention of name & designation), coded alphanumerically and not shared with anyone except the investigators of this study by the principal investigator, (3) any other aspect which discloses the identity of the recruited sample was blinded.

## Results

The first objective of this study was to design and validate an assessment toolkit based on WHO's Patient Safety Multi-professional Curriculum Guide Tool (MPCGT) 29. Hospital Survey On Patient Safety Culture (HSOPSC) versions 1 & 229 were selected, after carefully screening all available toolkits. Necessary changes as amenable to Indian settings, after taking due approval from the AHRQ were made. Later, a pilot study was conducted with 10% of the proposed sample size (n=300) of this study; a response rate of 63.33% was obtained (0.860 scores of Cronbach's alpha). This validated the toolkit. This validated was toolkit then administered to the entire study population. Data were obtained, compiled, pre-processed, and analyzed while maintaining due confidentiality.

The survey tool was distributed to 300 participants and only 227 responses [physical form (223), whatsapp (3) and email (1) of investigator] of 230 received in questionnaires could only qualify for data analysis (3 questionnaires were summarily rejected on grounds of being incompletely filled).

The questionnaire also had a communication number of the investigator, in case of any doubt/clarification on any aspect. Thus, the response percentage came to be 75.67% (Table 1).

Table 1: Response as received from healthcare staff

| Sl. No. | Designated Healthcare Staff in Selected Area | Sample recruited | Response as received | Response percentage |
|---|---|---|---|---|
| 1. | Faculty | 36 | 22 | 61.1 % |
| 2. | Resident | 96 | 76 | 79.2 % |
| 3. | Nursing Staff | 78 | 61 | 78.2 % |
| 4. | B.Sc. Nursing Final Year Student | 16 | 14 | 87.5 % |
| 5. | Technician | 74 | 54 | 72.9 % |
| Total | | 300 | 227 | 75.7 % |

In total, 53.74% of the respondents were males and 46.26% of the respondents were females. Thus, overall responses were slightly tilted towards males. The variation in the age group of the respondents for the current state of PSC (cPSC) - maximum response of n=84 (37.00%) was received from the 30-39 years age group (with 34 years > 31 years > 32 years).

In the work shift, the pattern of respondents on cPSC, with increasing age, the prevalence of general shift increases. In the employment profile of respondents, the dominance of regular employment kept varying over time.

We coded the answers based on 6 pointers Likert scale. A positively worded question on a spectrum of Not Applicable as 0 & Strongly Agree (or Always) as 5 and vice versa for negatively worded ones. The data, as obtained, was cleaned, coded, entered, and cross-checked prior to analysis. This was analyzed using SPSS 26.0.

The median variation across designation on cPSC in decreasing order of their obtained responses were Nursing Student (2.56) > Professor (2.53) > Assoc. Prof. (2.48) > Asst. Prof. (2.43) > Technician (2.30) > Resident (2.29) > Nursing Staff (2.26) and the interquartile range variation across designation in decreasing order of their responses was Resident (.72) > Technician (.71) > Asst. Prof. (.24) > Professor (.22) > Nursing Staff (.19) > Nursing Student (.18) > Assoc. Prof. (.12) respectively (Table 2). Thus, the average cPSC score across all composites was 46.35% (Table 3).

**Table 2:** Variation of average cPSC across designation

| Sl. No. | Designation | Mean | Median | Minimum | Maximum | Interquartile range | Standard deviation |
|---|---|---|---|---|---|---|---|
| 1. | Nursing Student (n=14) | 2.56 | 2.56 | 2.32 | 2.73 | .18 | .12 |
| 2. | Technician (n=54) | 2.30 | 2.30 | 1.86 | 2.57 | .71 | .15 |
| 3. | Nursing Staff (n=61) | 2.28 | 2.26 | 1.91 | 2.76 | .19 | .17 |
| 4. | Resident (n=76) | 2.27 | 2.29 | 1.92 | 2.64 | .72 | .17 |
| 5. | Asst. Professor (n=8) | 2.50 | 2.43 | 2.38 | 2.78 | .24 | .15 |
| 6. | Assoc. Professor (n=7) | 2.52 | 2.48 | 2.42 | 2.69 | .12 | .09 |
| 7. | Professor (n=7) | 2.53 | 2.53 | 2.33 | 2.72 | .22 | .13 |
| Overall Score (n=227) | | 2.32 | 2.33 | 1.86 | 2.78 | .25 | .18 |

**Table 3:** Average score for PSC composites

| Sl. No. | Sub-heads to be studied under HFE & PSC | Average positive Composite PSC Score (in %) | | |
|---|---|---|---|---|
| | | Study Setting, India | Taiwan | USA |
| 1. | Teamwork within units | 57.4 | 94 | 81 |
| 2. | Teamwork across units | 73.1 | 72 | 81 |
| 3. | Staffing | 18.6 | 39 | 56 |
| 4. | Handing-Taking over & Transitions in care | 21 | 48 | 58 |
| 5. | Openness to Communication | 43.2 | 58 | 68 |
| 6. | Organizational Learning | 61.4 | 84 | 72 |
| 7. | Supervisor's actions promoting Patient Safety | 44.8 | 83 | 81 |
| 8. | Management Supports for Patient Safety | 51.1 | 62 | 68 |
| 9. | Overall perception of Patient Safety | 57.4 | 65 | 66 |
| 10. | Patient Safety Grade | 53.3 | 65 | --- |
| 11. | Non punitive response to errors | 21.4 | 45 | 61 |
| 12. | Feedback & Communication about Error | 65.5 | 59 | 69 |
| 13. | Frequency of Events reporting | 42.4 | 57 | 74 |
| 14. | Number of events reported | 38.3 | --- | --- |
| Total | | 46.3 | 63.8 | 70 |

The top contributor to the positive domain of cPSC (Table 3) was the overall perception of PS (82.4%). The top contributor to the negative domain of cPSC (Table 3) was supervisor actions promoting PS (90.6%). The top contributor to the average positive score of PSC was teamwork across units (73.1%). The bottom contributor to the average positive composite score of PSC was Staffing (18.6%).

The trends of overall cPSC when compared with the working tenure in the Institute, present a unique picture. The trends of overall cPSC over the working tenure in the Institute present a unique picture when compared with the overall score of 46.35%. For the recruited healthcare staff who had been for over 180 days (inclusion criteria) to 364 days (n=64), the band score was in the range of 1.92-2.64 with a mean score of 2.30 or 46% which is 0.35% behind the cPSC score. A similar trend was seen in the recruited healthcare staff who had spent 1-5 years in SS (n=79), their range of overall band score was 1.92-2.78 with the mean score being 2.36 or 47.2% which is 0.85% above the mean score. Similarly, when the trend of recruiting staff who had spent 6-10 years in SS (n=79), their overall band score was in the range of 1.86-2.69 with the mean score being 2.33 or 46.6%, which is 0.25% above the cPSC score. Similarly, the trend for staff who had spent 11-15 years in SS (n=32), their overall band score was in the range of 2.09-2.76, with the mean score being 2.32 or 46.4% or 0.05% above the mean score. The trend of recruited healthcare staff who had spent 16-20 years in SS (n=8), their overall band score was in the range of 2.03-2.55, the mean being 2.31 or 46.2% which is 0.15% below the cPSC score. Lastly, when a similar trend was seen for recruited healthcare staff who have spent over 21 years in SS (n=4), their overall band score was in the range of 2.00-2.58, with the mean being 2.43 or 46.6% or 0.25% above cPSC score. Henceforth, the highest rise in the mean score (+0.85%) over tenure v/s cPSC was found in healthcare staff who had spent 1-5 years in SS, and its opposite (-0.35%) was found in healthcare staff who had spent >180 - <365 in SS.

The reliability statistics were run on entire data acquired (n=227) to assess inter-rater agreement using an Intra-class Correlation Coefficient (ICC) with a 95% Confidence Interval (CI). The average measure of ICC for a two-way mixed model was 0.009 using the consistency definition; therefore, 9% of the variance in the mean of this sample was real. When a similar test was run on cadre-specific values under similar conditions (95% CI for a two-way mixed model, using consistency definition) ICC for Faculty doctors (n=22) was 0.068, meaning, 6.8% of the variance in the mean of this sample was real; ICC for the Resident doctors (n=76) was 0.379, meaning 37.9% of the variance being real; ICC for the doctors (Faculty and Resident) [n=98] was 0.163, meaning 16.3% being real; ICC for the nursing staff (n=62) was 0.014, meaning 1.4% being real; ICC for the technician (n=55) was 0.100 meaning, 10% being real; ICC for Final year Nursing students (n=14) was 0.762, meaning 76.2% being real. The validity of the data thus acquired was run using Factor Analysis by Kaiser-Meyer-Olkin Measure of Sampling Adequacy, which came out to be 0.631. The scree plot showed an L-shaped dip after 5 values. Then Principal Axis Factoring (Varimax with Kaiser Normalization) and the results were found to have strong correlation amongst with inter alia variations (Factor 1 [range 0.169 - 0.702], Factor 2 [range 0.090 -0.606], Factor 3 [range 0.135 - 0.657, Factor 4 [range 0.098 - 0.785] and Factor 5 [range 0.100 - 0.896]). The data as acquired were run for normality test using the Kolmogorov-Smirnov Test, and the results were found significant except for excellent parameter of PS grade and parameter B16 ($p = 0.94$).

## Discussion

The results of this study seem encouraging by being in first of its kind to evaluate the cPSC of select SS, giving insights into the HFE (in association with PSC) which has a bearing on healthcare and its safety.

The overall response percentage of respondents of this study was 75.67% which is higher than 64%[29] 30,31 and 61% 30 when compared with international studies but is on the lower side when compared with that of 27 who reported it to be 100% each for the 3 hospitals under his study. In our study, it was found that, in overall received

responses, males choose to respond more than females but a cross-section of this data, further reveals that the females responded more than males in the cadre (designation) of Professor and Nursing Students only. Overall, there was a good mix of responses from diverse age groups, work profiles, and designations which are a good representative of the study population, but it definitely calls for further in-depth analysis.

Approx 80.6% of all the respondents had spent up to 10 years or more at our SS, hence they had adequate time to articulate their views and subsequent responses on PSC at their workplace and 65.2% of the recruited sample size worked 40-59 hours a week. The work hours per week of medical and surgical side residents and faculties stretched beyond this norm (> 80 hours per week), hence, showing their dedication and sacrifices towards patient care, impacting the equation of cPSC (and HFE). This response is in tandem with AHRQ's HSOPS 2019 database 29. The mean of responder's response about their immediate senior was 3.75 (75%) and a peculiar characteristic that was noted was, a high response (80%) in either positive or negative categories barring C3 statement 30 which calls for serious concern. The mean average response to communication by responders was 3.26 (65.2%) but the D5 statement 30 had an average mean of 3.90 (78%) showing a higher sensitivity towards AE and continuously evolving ways and means to learn from them. The mean response to AE reporting 30 by responders was 2.33 (46.6%) and the number of AE reported in the past 12 months came to be 2.22, which is in close consonance, indicating the deliberate attempt to hide mistakes or under-reporting. At our SS, there is the provision of mortality meets on Tuesdays, but the audience is minuscule & exclusive (only doctors are allowed) which also depicts the close-door shared-learning model 9,18,32,33. The above presumptions are further validated to an extent by a report from the Department of Anaesthesia, SS for the duration of August-October, 2019, which showed a 0.3% AE reporting rate 9,13 when compared with average surgery during that period. Thus, is line with global practices 9,32,33,34,35.

The mean PS grade as given by the responders was 2.73 (54.6%) which is 8.2% above the overall cPSC score of 2.32 (46.2%) - perceived v/s actual reality. The percentage of positive responses for Taiwan for this item is 65% 31 a little higher than the USA's 63% 30. A low cPSC grade in study areas calls for driving in measures to usher in a collective change for good. The mean average score for the hospital characteristics was 3.20 (64%), as proven by studies that communication has an important role to play in PSC 26,29,36.

*The highest mean average score to cPSC was shown by Nursing Students and later by Faculty (Asst. Prof., Assoc. Prof. & Prof.) and followed by Technician, Nursing Staff, and the Residents with results being statistically significant*. The highest score for Nursing Students can be attributed to the small sample size and their perspectives towards various aspects of patients, PS & positive attitude towards work as justified by their response to PSC parameters as they were just in the transition stage to being a full-fledged workforce. *This is of special significance, as they would in turn contribute to a better PSC in their workplace.* A similar study by 27 also found the highest score of clinicians across all cadres of staff, and results were found to be statistically significant in both cases. The higher composite score of clinicians may be explained by a higher probable patient-centric attitude, altruistic motives, and greater accountability towards patient outcomes among this group of healthcare workers 27. A similar study 37 showed the PSC score of 32% on Chief Medical Officers of 34 districts of U.P. A lot more inter-score variations in that of faculty can be attributed to their attitude and their overall duration of time already spent within the Institute, but overall it seems promising as shown by the results of this study. Thus, the overall grade of average positive cPSC is much lower in our SS *(Table 4)* calling for all-out efforts to act in unison, to raise the levels of existing cPSC. These results should also be seen in the light of various cultural features of Western & Eastern cultures and variations within. The veracity of the results in this study should be analyzed in light of being representative of only a small section of the study population at our SS.

**Table 4:** Average score for overall PSC composites across various studies

| Sl. No. | Sub-heads to be studied under HFE & PSC | Average positive Composite PSC Score (in %) | | |
|---|---|---|---|---|
| | | Study Setting, India | Taiwan | USA |
| 1. | Teamwork within units | 57.4 | 94 | 81 |
| 2. | Teamwork across units | 73.1 | 72 | 81 |
| 3. | Staffing | 18.6 | 39 | 56 |
| 4. | Handing-Taking over & Transitions in care | 21 | 48 | 58 |
| 5. | Openness to Communication | 43.2 | 58 | 68 |
| 6. | Organizational Learning | 61.4 | 84 | 72 |
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| 9. | Overall perception of Patient Safety | 57.4 | 65 | 66 |
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| 12. | Feedback & Communication about Error | 65.5 | 59 | 69 |
| 13. | Frequency of Events reporting | 42.4 | 57 | 74 |
| 14. | Number of events reported | 38.3 | --- | --- |
| | | 46.3 | 63.8 | 70 |

## Conclusion

Existing evidence from the various studies done in the past and key takeaways from this study clearly demonstrates the potential of HFE in cPSC scores. Although the overall cPSC score was 46.35%, a little on the lower side (when compared with the available database) as anticipated, with a 75.67% overall response percentage (better amongst peers) with internal variations.

A positive PSC recognizes the inevitability of error and proactively seeks to identify latent threats 38. A team built on a foundation of mutual trust and respect is bound to evolve over time, eliminating stressors and incorporating eustress 19; hence an institute is bound to develop a strong cPSC overtime. Looking forward to additional (and in-depth) conclusive research in the domain of PSC at our SS & across India.

### Recommendations

Unsafe acts are like mosquitoes. You can try to swat them one at a time, but there are always others to take their place. The only operative cure is to drain out the areas in which they sustain.

Thus, beginning with baby steps towards a safer and enabling tomorrow at our workplace, the recommendations deriving cues from our SS 39 & other seminal documents (29,3233,40,41,42) are described by 2I's- Institution & Individual levels:

A. **Institutional Level:**

- Communication led Confidence Building Measures (CBM) via:
  - Regular informal and formal review meetings
  - Greater use of digital modes of communication
  - *Managerial walk rounds* led to greater staff engagement

- Incorporating measures to ensure mandatory completion of PS course prior to completion of the first year of hospital service 39.
- Mortality Meets (Tuesdays, 08:00 am) at our SS are a good forum to highlight and discuss details that led to unexpected outcomes
- Structured handing-taking, coupled with bedside over of duties

o Customized:

- Cadre-specific education & training on aspects of HFE and PSC 43. Regular spaced Longitudinal In-service Training Programs at SS have made greater awareness as shared by study participants 44-46
- Staff engagement with awards led to motivation like Best Ward (Mar 2018) and Best Nurse (May 2019) awards.
- Operational Management Approach 47: Collaboration-led capacity -building exchange programs with like-minded facilities/ institutions.

o Introduction of Standardized Institutional periodic Adverse Drug Reporting 44 & Incident Reporting Format 46 with due safeguards for the reporter.

o A SS Patient Safety Standard Operating Procedure (SOP) on lines of NABH 23, Joint Commission International 48, Australian 3 & Canadian PS Framework 22 in agreement with NPSIF 49.

### A. Individual Level:

o Feedback from patients or healthcare staff

o Targeted, non-punitive interventions e.g., encouraging nurses to openly discuss safety issues 50 *"The chief nursing officers are not always taken seriously…..Nurses see everything. Nursing is kind of the canary in the coal mine" 42*,45.

o Problem Based Learning (PBL), Case-Based Learning (CBL) & Group tasks on cadre-specific examples in PS program to build greater connect 29.

o Fortnightly/Weekly/as situation warrants, ADE meets 46.

o An open non-punitive disclosure process can be instituted based on New South Wales, Australia model 29.

On the Fifteen-year anniversary of *To Err is Human*, Prof. William C. Richardson, President Emeritus of Johns Hopkins University said "Fifteen years ago the general belief was that medical errors came about because of impaired physicians," but, in contrast to that belief, *'To Err Is Human' found instead that medical errors occur because of a problematic health care system (or "non-system," as the report called it) marked by decentralization, fragmentation, faulty processes, or conditions that cause people to make* mistakes[33] which calls for constantly coordinated impetus[16] from top to down *levels.*

### 1.1 Limitations:

The findings and interpretation of this study must be considered in the light of the following limitations:

- This study was limited to select settings (& select designation/s) of healthcare workers of SS only and views are personal of a representative population.
- Subjective nature of the study process.
- Ergonomics was studied in association with Human Factors only.
- PSC measurement is a fast-growing field and as a result, this study mayn't have captured all relevant studies 51. The exclusion of other bibliographic databases and grey literature
- Non-English language journals/articles were not included
- Effect of stress on overall levels of PS & PSC response wasn't factored 30.

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