



Comparative analysis among doctors working in private and government hospitals in identifying and prioritizing essential stress factors during COVID-19- an AHP-TOPSIS approach



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HIGHLIGHTS

- The systematic method of stress determination and prioritization by MCDM process.
- Multiple stress factors were identified and analysed among doctors during COVID-19.
- TOPSIS and AHP were used to assess the important stress factors.
- The novel study analyses and prioritizes doctor stress levels by hybrid MCDM techniques.

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ABSTRACT

The spread of COVID-19 across the world, triggered multiple stresses among doctors working tirelessly round the clock to attend sick patients. Doctors had to cope with new environment thereby developing anxiety and fear. The current paper identifies and explores the stress intensity developed among doctors with the aid of multi-criteria decision analysis in doctors working in private and government hospitals of India during COVID-19. After identification of numerous stresses through questionnaire, weights are assigned to common most stress factors by employing AHP method. Furthermore, comparative analysis and prioritization of stress factors is performed with the aid of TOPSIS. The current combined system is a quantitative analysis furnished to establish the feasibility of the methods in weighing and MCDM in stress assessment. This study identifies and predicts the foremost stress factor which needs to be addressed by hospital management to keep doctors with a stable and fresh mindset. This research further establishes a proper MCDM technique which need to be applied in all hospital to regulate and distribute doctors work load without overloading them. Psychological stress is the foremost type of stress reported by multiple doctors. Results showed that lack of balance among personal and professional life followed by lack of communication is highly related problem in doctors in such adverse events.

1. Introduction

The COVID-19 epidemic has left the whole human race struggling on a global scale. Often people frequently indulge in recreational sports, social interactions, and time spent with family and friends as means to buffer ourselves from stress.^{1,2} However, social isolation and the

frequently shifting numbers of those who have died and those battling for their lives develops a sense of anxiety coupled with unproductive stress for those living in metropolitan areas. The major crisis which hit us in 2020, caused by the COVID-19 pandemic, has put a lot of pressure on individuals, especially medical workers.^{3,4}

In healthcare organizations that operate on the national and global

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levels, emergence of stress among healthcare workers is seen to be rapidly emerging damaging their mental state which is deemed to be a serious problem.^{5,6} However, in order to provide care for others, one must be cognitively, emotionally, and physiologically attentive. Healthcare workers seldomly make mistakes but due to their excessive load might lead to devastating and irrevocable results. Hence, it is necessary for healthcare workers to be mentally steady and immaculate frame of mind, free from worries and fears.⁷ According to earlier studies, the only parameter for determining stress levels among doctors is by identification and prioritization of parameters related to doctors mental and physical state.⁸ The current investigation predominantly stresses to approximate multiple set of the complications experienced by surgeons or specialist health workers (Doctors) by unexpected epidemic consequences recognizing chief difficulties specifically in a country like India where populace density per kilometre is alarmingly high.⁹

The true word system cannot be properly represented by data of crisp numbers, according to earlier studies.¹⁰ This inadequacy is a result of the haziness, inaccuracy, and subjectivity of human judgement, thinking, and choice. The fuzzy set theory was created to fill the gap and replicate the ambiguity of human judgement. In the fuzzy set theory, linguistic values are used to pick decision-makers.¹¹ The MCDM problem is then solved by converting the selections to fuzzy numbers. Thereby, the applied combined model is able to overcome several constraints associated with survey-based data by integrating the analysis of TOPSIS with AHP set theory to ascertain weights to parameters and prioritizing them based on analysis.¹² By doing this, the decision-makers are able to include partially ambiguous facts and unmeasurable, incomplete, or unattainable information into the decision model.¹³

Liu et al (2020).¹⁴ analysed various types of stresses developed among coach drivers with the aid of hybrid multiple criteria decision making (MCDM) techniques and found insufficient pay to be their biggest concern among other problems. Rajabi et al (2020)¹⁵ studied and analysed the occupational stressors among firefighters with the aid of MCDM techniques. The research established that the most significant stress in these workers was financial strain, followed by fear of explosion at incident scenes. Islam et al (2022)¹⁶ studied the various problems incurred by supply chain suppliers and created a prioritization model using AHP-TOPSIS hybrid MCDM model. Upkeep of a suitable equilibrium amongst stock and mandate was found to be the prime problematic area which impacted the retailers. Ahmad et al (2022)¹⁷ reviewed and ranked various solar energy determination techniques the approach of MCDM (AHP-TOPSIS). In the prioritization process of soft computing techniques for prediction of solar radiation, ANN was found to be the best technique for efficient determination.^{18,19} By analysing the above literature survey, it can be said hospital management stress analysis, have been rarely and uncommonly studied in times of epidemic. Moreover, the weightiness assigning process for suggested doctors' complications is not once addressed previously, deeming the contemporary work extremely novel and exclusive. Ranking major problems encountered by doctors from both domain private and government will produce a viable and deep-rooted framework to hospital management thereby distributing workload in a easy manner without overburdening any doctor. Thus, by properly forecasting such stress tensors beforehand, will be able to solve them before it even happens, hence making the present study innovative, definite and precise. The literature survey method is accomplished keeping in view of several research trainings, case lessons, proficient thoughts etc. as shown in Fig. 1.

Through detailed literature survey, it is found that, identification of stress developed in doctors has been accomplished without signifying or assigning weights to specific stress. Moreover, in previous studies, each defined stress classified on the basis of different problems are compared by assigning equivalent weight to all identified stresses.²⁰ Nevertheless, in an ideal scenario, some stress criterions have greater impact on problems than other stresses, henceforth becoming the foremost limitation in the previous analysis. In view of the recent COVID-19 pandemic, investigators are motivated to discover an exact, precise, dependable

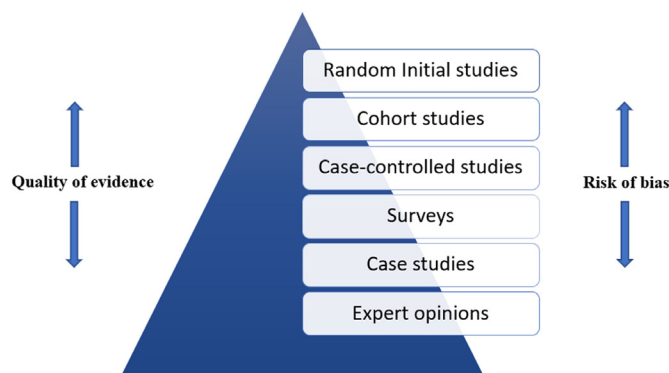


Fig. 1. Levels and process of literature survey for this particular research.

framework of recognizing multiple stress and problems encountered by doctors in hospital, which formerly has not be accomplished by employing hybrid multi-criteria decision (MCDM) models. As a result, TOPSIS was used to recognize the significant stress factors based on several criteria, while AHP is adopted to establish the weight of every criterion.²¹ Additionally, these methods have been recognized as a successful method for articulating decision-related problems using ambiguous and imperfect information. In order to increase safety of patients, TOPSIS and AHP set theory were combined, and further was used to assess the decision-makers' choices.²² Ultimately, the complexities stated directly above can be correlated with the constraints in previous researches, the present work is a formulation of an analysis, capable of identifying and associating several problems encountered by doctors developing multiple stresses in the process, thereby ranking them from top to bottom execution principles.²³

In the current era, COVID-19 virus is still prevalent which may again turn volatile at any point of time. Keeping a positive and stress-free frame of mind among doctors is of prime importance as it will increase doctors' productivity and efficiency at hospitals, thereby serving the community in saving multiple lives.²⁴ As a result, this investigation is desperately vital since it will reveal and prioritize possible stresses developed, despite the fact that there are many other unimportant stresses among doctors, which were earlier given similar weight in previous studies. The research is also one of the few official scientific studies that concentrates on India and is the first to utilize pairwise comparison to rank and show causal links between the numerous occupational stress variables impacting Indian doctors.²⁵

The contemporary research's main objective is to establish a feasible framework based on a cause-and-effect link between occupational stress components, thereby offering a novel viewpoint seldomly researched in prior studies. Another objective of the study is to establish strong evidence in practice, prioritizing stress factors among doctors of which stress factors act as causes of other stress factors or which stress factors lead to other stress factors in order to encourage research-driven strategy for their management.

The detailed objectives of the present study are explained below.

- Selection and classification of various types of stresses which impact the wellbeing of doctors on the basis of previous literature and questionnaire.
- Converting professional expert opinions into number based variable quantity in order to formulate an assessment matrix for various stress weight estimation.
- Weight determination by analytical hierarchy process (AHP) technique for various stresses constructed on advanced linguistic matrix.
- Evaluation of numbers for numerous difficulties responsible for developing stress among doctors and prioritizing them on the basis of ranking task.

To summarize, this research's goals are to determine the impact of stress factors on doctors working in government and private hospitals in India and thus prioritize and identify causal links between the multiple stress elements using MCDM. We collaborate with the leading credible medical online platform comprising of top-notch doctors across in India to address the aforementioned queries and distribute surveys via two authorized ways. To process data with high standard and dependability, we employ both qualitative and quantitative methodologies.

2. Method and data collection

2.1. Identification of criterions

After identifying multiple stresses commonly found among doctors, several criterions are recognized and measured for the examination of doctors stress levels in the time of epidemic as enlightened below.

- **Physical Stress**

When COVID-19 hit, most of the people were locked in their homes, but the doctors were considered as frontline warriors saving people by risking their own life. Doctors had to go through several trials not only affecting their mental state but drastically draining them physically.²⁶ Moreover, these doctors also had to take care of wailing patients relatives and their families. Prior researches have also advocated for the exposed levels of stress and anxiety in their daily workplace, being more prone to physical stress as compared to mental stress.²⁷ Doctors, around the country are reporting more and more physical burnout, strained nerves and acute bodily exhaustion precisely due to extended work time and growing patient workload.

- **Environment Stress**

All major healthcare workforce is terribly influenced by inappropriate working environments, either for a government or private hospital.²⁸ Whatsoever be the atmospheres, they have incredible ability to influence our mental wellbeing enormously. The working environment of any hospital should be safe and stable at the same time to produce clarity of work among doctors.²⁹

- **Psychological Stress**

In recent times, a sudden surge in number of cases for psychological stress has been seen among doctors undergoing specific problems such as stress, depression, anxiety, etc.³⁰ This stress further translates into a feeling of exhaustion amongst doctors from various domains eventually resulting in major lapses in patient's upkeep. This is evidently proved various previous researches where at least 33% of doctors have reported exhaustion and burnout at some point of their career.³¹ Regularly checking and upgrading the mental upkeep of doctors will aid in better patient care and successful operations and diagnosis. This can be furnished by regularly checking and identifying long stress hours of doctors, carefully furnishing the exhaustion point.³²

- **Social Stress**

Basically, multiple situations arise where a person has to interact socially with other group of people. This requires the person to adjust to a situation where it can impact the inter-relationship, sense of approval in terms of broader aspect.³³ In past such stresses are seen to uprise from numerous situations where there might be circumstances silence for social acceptance. It is often seen doctors working for several hours develop a sense of anxiety. Unease or social anxiety syndrome is a therapeutic state that a variability of authorities can indulge.³⁴ These can be treated by making social groups or supports system who care and back each other when other is down.

- **Emotional Stress**

Emotional stress is another essential category of stress which needs to be contemplated since such types are considered to be quite regular reaction to daily life pressures.³⁵ Fear, anxiety, irritation, grief and other emotions are also all regular emotive outcomes. All of these are considered a major part of lifecycle.³⁶ Nevertheless, if the strain that inspires these reactions restricts the capability eventually resulting into hypertension further translating into unhealthy behaviour.³⁷ Consistent intellectual emotional check-ups can discovers behaviours to aid you manages, diminish the impacts of emotional distress, supports them to feel better and develop more practical and sorted issues in your daily life.

- **Cultural Stress**

Cultural stress is primarily interpreted and identified as culture surprise, which is found to be quite normal when repositioning to a new city, thereby experiencing new philosophies.³⁸ Doctors are required throughout the country based on emergency or nature of the operation to be executed. India is a country of vast cultures, thereby each medical personnel have to amend itself in a new culture whenever he changes the city. Culture stress might transform into different types of problems such as depression, irritability and homesickness.³⁹ Although most of doctors in this study are Indian natives but to understand the correlation of each stress, this variable has also been taken into consideration.

Similar studies have been developed in past, only identifying stress variables but no prioritization of such stresses has been ever reported among doctors. Furthermore, in past different policies have been improvised for doctors to keep their mental and physical condition stable. therefore, the above specified stress variables are classified as the major constraints which impact the doctor's wellbeing. These criterions are additionally converted into a well-defined feedback form which is prearranged to multiple doctors considered as potential candidates for the review process. Finally, assigning calculated weightage and prioritization to each stress constraint.

2.2. Data collection

Initially, the design of data comprises of selection of a particular area which consists of hospitals from both field government and private, as the study will identify and compare top most stress developed in doctors from both the domains. The state Uttar Pradesh was purposely chosen as it is one of largest states in India, also being densely populated. Doctors from both the sectors were selected based on their experience during COVID-19 pandemic.⁴⁰ To estimate the correct size of the sampling process, Quota sampling process is applied, which is capable of estimating the exact number for a feasible result. UP being a state of wide variety of doctors, which aids in estimating the feasible sample size.⁴¹

Prior literature survey established in above section was collected from a variety of sources to ascertain the feasibility and novelty of the current work. Henceforth establishing the superiority of AHP-TOPSIS model in other fields of study, the current research is aimed at investigating multiple stress parameters among doctors from both sectors government and private, thereby identifying the common most stress which can be irradiated before its development among doctors.

After quota analysis the approximate sampling size came out to be 240. The questionnaire was distributed among 300 various doctors from both sectors so as to suffice any late response and incomplete forms. After careful contemplation 275 responses were returned, while deemed 22 were considered to be unfit from the study due to incomplete data which is one of the primary limitations of such analysis. Hence 252 responses were used to approximate the analysis. Further, the data is transformed into linguistic variables for the identified stress levels.

The stress reasons were identified and further employed in framing the AHP-based questionnaire linguistic tables for pairwise assessment.

2.3. Participants information

Table 1 distinguishes various attributes associated to participants of the survey. Primary data is gathered through online and in person questionnaires, which is further translated into a well-defined hybrid prioritization study. Most of the doctors who decided to become potential candidates of the study lie in the age bracket of 31–60, while the primary sex of the respondents is male. Additionally, all doctors have a valid MBBS degree while some have masters also which represent 40% of the survey population. Data collection was a mix of online and offline forms filled by respective doctors of Aligarh hospital, UP and Meerut government hospital, UP. Initially survey data included traits of survey participants which covered multiple categories such as hospital type, sex and age bracket. The collected information is necessarily used to comprehend the problems and stresses in doctors by understanding their frame of mind through a well-defined questionnaire. This data is compulsory as it predicts the development of multiple types of stresses among doctors which can be effectively lowered to increase their performance. Numerous sessions were carried out with doctors of various streams to gather the data in identification numbers given a particular number between 1 and 5.1 is very low, 2 is low, 3 is medium, 4 is high, 5 is very high.

3. Methodology

After establishing data through a structured questionnaire in previous section, the research then moves towards establishing usefulness of the framework by designing a pairwise matrix comprising of all characteristics and their respective comparison in tabular form given in Table 1. Doctors working in private and government sectors might be subjected to different forms of stress while working in hospitals. Hence their share of experiences was graded on a five-point scale associated stress intensity levels, grading from ideal most situation to ideal least situation they have undergone during the pandemic. The research after identification of possible criteria divides stress levels into multiple parametric constraints such as Physical Stress, Environment Stress, Psychological Stress, Social Stress, Emotional Stress and Cultural Stress which form the basis of the AHP weightage assignment process. Furthermore, possible problems which will be ranked according to weightage assigned to constraints, thereby prioritizing the particular problem which is extremely prevalent amongst doctors. The above questionnaire was prepared on five-point scale (i.e., 1: Very Low Stress; 2: Low Stress; 3: Medium Stress; 4: High Stress; 5: Very High Stress); to examine the given set of alternatives

Table 1
Resident doctors general information.

Population Descriptor	Sub classification	Frequency
Sex	Male	156
	Female	96
Work Area Location	Metro city	187
	Urban city	65
Age (in years)	21–30	53
	31–40	85
	40	114
Specialization	MBBS	180
	MD	72
Surplus work hours	<1	45
	1–3	115
	4–6	92
Effort features	Feeling overloaded	69
	Overtime (hrs per week)	51
	On-call responsibility	22
	Job control	59
	Teamwork	20
Healthiness pointers	Supervisory fairness	31
	Self-rated health	130
	Diagnosed illness	35
	Minor psychiatric morbidity	79

among 252 participants. The final decision matrix displaying constraints is shown in Table 2.

The contemporary research establishes weightages to multiple stress criteria. Recent pandemic has cumulatively impacted every industry in the country especially health industry. Owing to the epidemic numerous information required at that particular instant could not be attained due to unfortunate close throughout the country. As a direct consequence, AHP is preferred as it authorizes indiscretion which is a product of insufficient data about principles and immediate adoptions, and absence of fixation amid pairwise examinations. Information achieved through survey essentially requires supreme exactness and correctness in recognizing and ranking the prime problem suffered by various doctors. Henceforth, this can be attributed as the major reason of selecting TOPSIS as the end outcomes achieved are procured with highest uncomplicatedness, reasonableness, unambiguousness, decent mathematical productivity, and capability to quantify the comparative performance for every problem specified through an easy mathematical system.

3.1. Analytical hierarchy process (AHP) weight assigning procedure

The present AHP technique was initially introduced by Saaty with the main goal of developing a novel process of analysing the weight of multiple criteria by a relative measurement method purely based on qualitative and rational ideologies. It is a famous tool earlier used in multiple researches for classifying multiple aspects based on this judgemental tool. In other words, it can also be seen as a conflict solving technique where optimisation of multiple outcomes might result in irregularity in the problem statement. Therefore, the particular technique permits the problem statement to signify multiple weights to different criteria, thereby maintaining the regularity and reliability of the problem statement.

The subsequent problem solved by AHP is explained below in multiple steps: -

Step 1: In the primary stage, we need to recognize the objectives needed to achieve, eventually bringing the number of choices down to below required number.

Classifying constraints and judgement them built on a computable feature necessitates applied proficiency of an experienced skilled persons who can existing contemporary a appropriate clarification and arrangement of the accessible possibilities.

Step 2: A Through valuations requirements to be accomplished, which off the record into two segments: (i) Amongst Characteristics of the problem (ii) Amongst numerous Substitute results that accomplish each requirement.

Specialists of the compulsory arena have established matrices which investigates characteristics on a prime scale extending between 1 and 5.

The amount of interconnected vectors is premeditated by means of the formulation (nxn), where n stipulates the amount of characteristics.

Step 3: Let X_{ij} specifies the i th factor's importance position in judgement to the j th factor. Afterwards that, $X_{ji} = 1/X_{ij}$.

Table 2
Identified stress characteristics with their designated credentials.

Criteria	Designation
Physical Stress	C1
Environment Stress	C2
Psychological Stress	C3
Social Stress	C4
Emotional Stress	C5
Cultural Stress	C6

Step 4: Formulation of a consistent pair-wise medium which is formed for the functional arrangement in subsequent sub-steps: -

- (a). Estimate and formulate the over-all sum of all columns.
- (b). Remove the resultant columns from the sum to each element of the matrices.
- (c). For receiving the comparative weights, estimate the amount of rows.

Step 5: Application of Eq. (1), the Evaluation matrix I attained, peak Evaluation outcome, and Criterion index (CI)

$$CI = \frac{\lambda \max - n}{n - 1} \tag{1}$$

The Eigenvector of the conjoined analysis matrices is zenith, and the amount of parameters are n.

Step 6: Reapplying Eq. (1), the consistency ratio (CR) is evaluated (2).

where RI means random index,

$$CR = \frac{CI}{RI} \tag{2}$$

3.2. TOPSIS assignment

The tables extracted for weight determination are further transferred to prioritization model such as TOPSIS. This technique further validates the stress criterions so as to priority ranking for different set of problems suffered by doctors in hospitals. It includes of subsequent phases in developing feasible prioritization model.

Step 1: Collect all possible information pertaining to doctors for ranking prioritization process concerning the vital assessments of the consequence answers in linguistic relationships such as extremely low, low, average, high, extremely high given by doctors.

Step 2: Converting numerous linguistic principles into numbers.

$X_{abN} = (I_{abN_s})$ Where, a = 1, 2, 3 m; b = 1, 2, 3 n, where,

$$a = \min\{I_{abN}\}, b = \frac{1}{N} \sum_{N=1}^N P_{abN}, c = \max (u_{abN}) \tag{3}$$

Step 3: Estimate the consequence answers for the collective weights.

$$B = [P_{ij}]_{m \times n} \tag{4}$$

Here, i = 1, 2, 3, ..., m; j = 1, 2, 3, ..., n

$$P_{ij} = \left(\frac{a_{ij}}{c_j^*} \right); c_j^* = \max c_{ij} \tag{5}$$

$$P_{ij} = \left(\frac{a_j^-}{c_{ij}} \right); a_j^* = \min a_{ij} \tag{6}$$

Step 4: Normalize the global output matrices.

$$V = [v_{ij}]_{m \times n} \text{ where, } i = 1, 2, 3, \dots, m; j = 1, 2, 3, \dots, n \tag{7}$$

$$\text{Here, } v_{ij} = p_{ij} (\times) w_j \tag{8}$$

Step 5: Figure out the homogenous weighted matrices.

$$A^+ = \{v_1^+, \dots, v_n^+\} \text{ Where,} \tag{9}$$

$$v_j^+ = \{ \max (v_{ij}) | Fj \in J; \min v_{ij} | Fj \in J' \}, j = 1, 2, 3, \dots, n \tag{10}$$

$$A^- = \{v_1^-, \dots, v_n^-\} \text{ Where,}$$

$$v_j^- = \{ \max (v_{ij}) | Fj \in J; \min v_{ij} | Fj \in J' \}, j = 1, 2, 3, \dots, n \tag{11}$$

Step 6: Establish the optimal solutions that are both positive and negative.

$$d_i^+ = \left\{ \sum_{j=1}^n (v_{ij} - v_{ij}^+) \right\}^{1/2}; i = 1, 2, \dots, m \tag{12}$$

$$d_i^- = \left\{ \sum_{j=1}^n (v_{ij} - v_{ij}^-) \right\}^{1/2}; i = 1, 2, \dots, m \tag{13}$$

Step 7: Calculate the variances amongst the definite data collected from optimum both positive and negative.

$$CC_i = \frac{d_i^-}{d_i^- + d_i^+}; i = 1, 2, \dots, n \tag{14}$$

Step 8: Approximate the ultimate value of closeness coefficient (CC) and simultaneously approximate the prior investigational values based on them, preliminary with the study pertaining to the zenith CC value manifested with maximum rank. The rank reduces with decreasing CC value.

Table 3 demonstrates the linguistic peers allocated to the output stresses.

The vital weightage allocated to separately criterions in linguistic counterparts were autonomously estimated by a decision-management participant of the private and government hospital.

Table 4 establishes the stress based combined weightages achieved from different problems. In order to create the optimum formulation, a homogenous weighting feature is used.

4. Result and discussion

So-often several problems in real life are solved by comparing multiple alternatives, in the end choosing most favourable one. But these alternatives are compared on the basis of some constraints. Even stress can be identified on the above criteria by classifying and dividing multiple stress levels into a hierarchy. Subsequently, this classification is designed for MCDM problem by reliably assigning linguistic variables to constraints, thereby achieving the purpose of selecting substitutes through merging connotations within each of the preferred constraints.

Table 3
Quantified values assigned to the result stresses.

S.No	Challenges	(P1)	(P2)	(P3)	(P4)	(P5)	(P6)
P1	Shortage of resources	5	4	2	5	3	1
P2	Long working hours	1	2	2	4	2	2
P3	Time pressure	3	3	5	4	1	1
P4	Lack of appreciation	4	5	5	3	5	2
P5	Lack of reward	4	3	5	3	3	1
P6	Lack of recognition	5	2	4	2	4	1
P7	Financial incentives	5	4	3	5	2	1
P8	Lack of balance among personal and professional life	4	1	4	3	1	1
P9	Lack of support	5	5	1	1	3	2
P10	Lack of communication	5	2	5	1	1	1
P11	Lack of access	1	4	2	5	3	1

Table 4
Combined weights project procedure by participants of the study.

Criterion	Type of Stress Developed	Weightage
C1	Physical Stress	0.25
C2	Environment Stress	0.11
C3	Psychological Stress	0.37
C4	Social Stress	0.16
C5	Emotional Stress	0.10
C6	Cultural Stress	0.01

After establishing the stress factors weight assignment process begins by weighted classification of stress levels by AHP technique. Weight identification further leads to transporting the values in TOPSIS analysis for rank and prioritization of alternatives. These combined methods have earlier proved to be viable model for previous researches also.

The primary stage in MCDM problem involves converting the outcome into a hierarchical arrangement comprising of determination, constraints, and sub-constraints for creating the framework. The fundamentals are then assessed in pairs concerning the consequence of the unbiased outcome. As explained earlier stress levels among participants was described on a scale of 1–5. Generally, conventional questionnaire is complex to interpret since it involves quantifying experiences into data or numerals. Thereby conversion of responses into linguistic terms is essential to simplify the overall analysis. By applying these linguistic variables, the MCDM problem becomes easier for choice maker since the priorities can be estimated through weighed method, thereby setting a certain degree of importance to one particular constraint. This level of significance often varies from country to country probably due to cultural difference or difference in opinion. Due to this decision makers are able to apply higher or lower weight to certain parameters increasing or decreasing their influence in the final ranking developed.

This section in specific investigates the questionnaires responses from doctors furnished in linguistic relationships, in addition employing weights to every criterion with the utilisation of AHP procedure. Furthermore, TOPSIS investigation offers the ranking examination on the account of above attained weights, thus recognizing the main problem suffered by doctors.

4.1. AHP weightage assignment

After establishing the stress classification in the form of a hierarchy, weights need to be assigned for several constraints considered in the study by AHP method. Weight assignment process involves transforming responses of participants for given questions into a pairwise matrix with all constraints stacked in tabular form.

AHP model development commences with generating weights for characterised set of stresses, thereby prioritizing specific problems influencing doctors well-being.

Six chief stresses have been documented which might impact doctors working process in hospitals. Primarily, earlier applied model is only accountable for transferring weightages to several considered stress values. Additionally, the problems classified on the above criterions are further ranked and rated. The quantified values are articulated in linguistic variables conferring to multiple weightages to attain an order as portrayed in Table 5.

The principles from the distinct pairwise assessment matrix was derived to compute the group pairwise comparison matrix. After normalizing the pairwise assessment matrix with respect to positive attributes and negative attributes, we calculate the mean number of individual row vector which results into weights for each constraint, as established in Table 7. Submission of AHP styles and estimates universal weightages of the characteristics, organized in a tabular arrangement by delivering definite points to individual parameters based on the attained value as revealed in Fig. 2.

The general position according to weights with their prioritization are

Table 5
Weights allocated to the problems.

S.No	Challenges	(C1)	(C2)	(C3)	(C4)	(C5)	(C6)
Weightages		0.25	0.11	0.37	0.16	0.10	0.01
Importance Criteria Rank		2	4	1	3	5	6
P1	Shortage of resources	5	4	2	5	3	1
P2	Long working hours	1	2	2	4	2	2
P3	Time pressure	3	3	5	4	1	1
P4	Lack of appreciation	4	5	5	3	5	2
P5	Lack of reward	4	3	5	3	3	1
P6	Lack of recognition	5	2	4	2	4	1
P7	Financial incentives	5	4	3	5	2	1
P8	Lack of balance among personal and professional life	4	1	4	3	1	1
P9	Lack of support	5	5	1	1	3	2
P10	Lack of communication	5	2	5	1	1	1
P11	Lack of access	1	4	2	5	3	1

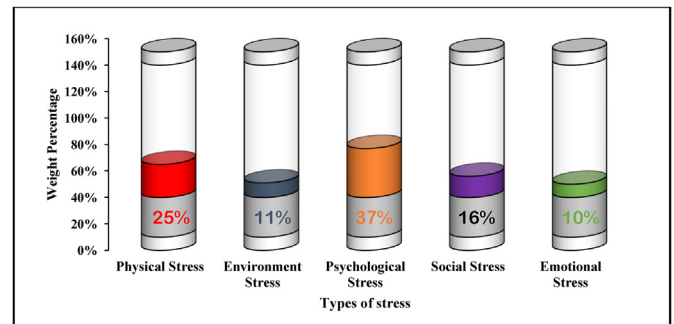


Fig. 2. Impact of numerous criterions on doctors mindset.

recognized in Table 6.

With the aid of combined process of hybrid MCDM process, the weightage investigation provides that, it is evidently comprehended that maximum weight or zenith priority should be given to doctors undergoing psychological stress (37%), while for cultural stress it comes out to be the lowest (1%). After the study it can be elaborated that doctors undergoing psychological stress are considered to be in a larger array of problems while doctors who have marked cultural stress as a priority are undergoing least number of problems.

Consistency ratio of the pairwise comparison matrix is calculated which came out to be in the range of $0.055 < 0.1$ which is acceptable for any MCDM analysis. Accordingly, the generated weights are deemed to be reliable and further transported to TOPSIS method to establish ranking of related stress levels among doctors. After establishing the decision matrix with their calculated weights as shown in Table 6, psychological stress attains top most weight and highly rated among doctors as the prime factor of stress development during the COVID-19 pandemic. Also, the views of other doctors are similar concerning the following constraint, also being a common viewpoint of other doctors. The other constraint which is second most common agenda among doctors is the Physical Stress which too has been allotted an appreciable prioritization as compared to other constraints.

Table 6
Priority levels of parameters on the basis of derived weights.

Attributes	Weight	Importance criteria rank
Psychological Stress	37%	1
Physical Stress	25%	2
Social Stress	16%	3
Environment Stress	11%	4
Emotional Stress	10%	5
Cultural Stress	1%	6

Table 7
Regularized verdict matrix.

S.No	Challenges	(C1)	(C2)	(C3)	(C4)	(C5)	(C6)
Weightages		0.25	0.11	0.37	0.16	0.10	0.01
Importance Criteria Rank		2	4	1	3	5	6
P1	Shortage of resources	0.37	0.35	0.16	0.42	0.32	0.10
P2	Long working hours	0.07	0.18	0.16	0.34	0.21	0.20
P3	Time pressure	0.22	0.26	0.40	0.34	0.11	0.10
P4	Lack of appreciation	0.29	0.44	0.40	0.25	0.53	0.10
P5	Lack of reward	0.29	0.26	0.40	0.25	0.32	0.10
P6	Lack of recognition	0.37	0.18	0.32	0.17	0.43	0.10
P7	Financial incentives	0.37	0.35	0.24	0.42	0.21	0.10
P8	Lack of balance among personal and professional life	0.29	0.09	0.32	0.25	0.11	0.10
P9	Lack of support	0.37	0.44	0.08	0.08	0.32	0.20
P10	Lack of communication	0.37	0.18	0.40	0.08	0.11	0.10
P11	Lack of access	0.07	0.35	0.16	0.42	0.32	0.10

4.2. Technique for order performance by similarity to ideal solution (TOPSIS) modelling

Prioritization is proficient in attaining priority to multiple options of stresses which might be prominent among doctors. This importance is attained by gathering the information taken through surveys as displayed in Table 5. The whole system works on a combined methodology as per the MCDM model. To further contemplate the values attained in earlier sections, this section validates the weightages which have been further investigated based on problems studied by TOPSIS background.

In the meantime, the units of the stress variables analysed above were fairly unrelated, henceforth they were regularized to change into a equivalent ranges in linguistic values as revealed in Table 7.

Matrix was again transformed into, global performance values which remained estimated based on the weightages attained from weight providing method and values achieved for different stress criterions were assigned against each problem faced by doctors. The scores were gained after regularizing the weights from the combined matrix operations is displayed in Table 8.

The performance value of every stress model is evaluated after accessing the optimum best and ideal worst values. Furthermore, the Euclidean distance in particular phases as revealed in Table 9 (see Table 10).

Based on the results of the closeness coefficients, ranks of the most essential problems on the basis of multiple stress criterions is summarized as follows: Lack of balance among personal and professional life > Lack of communication > Long working hours > Lack of access > Time pressure > Lack of recognition > Lack of reward > Lack of support > Financial incentives > Shortage of resources > Lack of appreciation.

Fig. 3 illustrates the collective linguistic values set by multiple doctors. This is useful in creating a contrast amongst several stresses for ideal

Table 8
Subjective regularized operated matrix.

S.No	Challenges	(C1)	(C2)	(C3)	(C4)	(C5)	(C6)
Weightages		0.25	0.11	0.37	0.16	0.10	0.01
Importance Criteria Rank		2	4	1	3	5	6
P1	Shortage of resources	0.10	0.09	0.02	0.07	0.03	0.02
P2	Long working hours	0.02	0.05	0.02	0.06	0.02	0.02
P3	Time pressure	0.06	0.07	0.04	0.06	0.01	0.02
P4	Lack of appreciation	0.08	0.12	0.04	0.04	0.05	0.02
P5	Lack of reward	0.08	0.07	0.04	0.04	0.03	0.02
P6	Lack of recognition	0.10	0.05	0.03	0.03	0.04	0.01
P7	Financial incentives	0.10	0.09	0.02	0.07	0.02	0.01
P8	Lack of balance among personal and professional life	0.08	0.02	0.03	0.04	0.01	0.02
P9	Lack of support	0.10	0.12	0.01	0.01	0.03	0.03
P10	Lack of communication	0.10	0.05	0.04	0.01	0.01	0.01
P11	Lack of access	0.02	0.09	0.02	0.07	0.03	0.02

performance by swapping off among many other features.

The contemporary examination in conclusion furnishes the supremacy of one stress over other and optimises the problems ascertained by doctors.

4.3. Discussion

After regress survey process through multiple doctors, the problems suffered by them are arranged in descending order is as follows: **Lack of balance among personal and professional life > Lack of communication > Long working hours > Lack of access > Time pressure > Lack of recognition > Lack of reward > Lack of support > Financial incentives > Shortage of resources > Lack of appreciation.** Evidently doctors found it hard to balance their personal life while dealing with professional patients. The number of patients during this time was tremendously high, due to which doctors got little time to go back and spend some quality time with family, thereby this being the common most problem found in almost every doctor. Also, doctors performance deteriorated since they kept losing motivation and commitment, thereby developing a feeling of disengagement. This is followed by lack of communication, since most doctors felt being exploited by hospitals due to excessive workload and long working hours. Hence this is the second most common problem seen among doctors.⁴² To resolve such issues, hospital management should hire separate managers who constantly access doctors which will enable a stress-free environment and improved overall performance of doctors. Additionally, hospital management should encourage doctors to speak up their issues, also helping them to sort complicated problems related to hospital working environment. Next is the long working hours followed by lack of access and then time pressure.⁴³ The least affected problem is identified as lack of appreciation since doctors were hugely supported and hailed as warriors in these tough situations, henceforth this problem is the least listed by doctors.⁴⁴ The modelled outcomes also revealed that financial factor came out to be one of the least problematic factors among doctors. However, most people believe that good doctors leave the country for better incentives in the wake of brain drain which is not true as proved from the study.⁴⁵ The doctors are more than happy with current pay and have no issues with financial crises, thereby ranking it 3rd from the bottom. This result validates the verdicts of Vander-Colff and Rothmann,⁴⁶ which applied a different model and found out that lack of support from colleagues at work serve as source of stress for professionals in their working environment. This shows that support from co-workers serves as mental upgradation among doctors which is considered necessary if their hospitals will stimulate the best from doctors.

4.4. Justification of anticipated model with prior models

The hybrid framework organized in the current research is validated by other literature analysing stress in doctors, thereby identifying the common most problem among doctors. The outcomes produced by hybrid modelling of AHP-TOPSIS were considered to be extremely close and in accordance with similar literature established. To validate our claim, and simultaneously defend the above model and parameter selection, previous related studies are recalled and associated as displayed in Table 11. In agreement through previous recognized complications, the contemporary work has revealed the identical trend of superior correctness in sensing problem as in case of AHP-TOPSIS modelling, thus confirming the anticipated combined framework.

5. Conclusions, policy and limitations

The unending era of COVID-19 pandemic is indisputably one of the most disturbing events in the last century or so. The people who had to undergo trauma at the zenith level healthcare workers. Long working hours, constant arrival of sick patients and mental trauma took a never-ending toll on doctors. On a worldwide level, this research can subsidize

Table 9
Positive and negative optimum resultant matrix respective scores.

S.No	Challenges	(C1)	(C2)	(C3)	(C4)	(C5)	(C6)	P _i Score
Weightages		0.25	0.11	0.37	0.16	0.10	0.01	
Importance Criteria Rank		2	4	1	3	5	6	
P1	Shortage of resources	0.10	0.09	0.02	0.07	0.03	0.02	0.26
P2	Long working hours	0.02	0.05	0.02	0.06	0.02	0.02	0.53
P3	Time pressure	0.06	0.07	0.04	0.06	0.01	0.02	0.49
P4	Lack of appreciation	0.08	0.12	0.04	0.04	0.05	0.02	0.23
P5	Lack of reward	0.08	0.07	0.04	0.04	0.03	0.02	0.41
P6	Lack of recognition	0.10	0.05	0.03	0.03	0.04	0.01	0.47
P7	Financial incentives	0.10	0.09	0.02	0.07	0.02	0.01	0.28
P8	Lack of balance among personal- professional life	0.08	0.02	0.03	0.04	0.01	0.02	0.68
P9	Lack of support	0.10	0.12	0.01	0.01	0.03	0.03	0.34
P10	Lack of communication	0.10	0.05	0.04	0.01	0.01	0.01	0.60
P11	Lack of access	0.02	0.09	0.02	0.07	0.03	0.02	0.50

Table 10
Prioritization of multiple problems transforming into various stress.

Challenges	P _i (Score)	Rank
Shortage of resources	0.26	10
Long working hours	0.53	3
Time pressure	0.49	5
Lack of appreciation	0.23	11
Lack of reward	0.41	7
Lack of recognition	0.47	6
Financial incentives	0.28	9
Lack of balance among personal and professional life	0.68	1
Lack of support	0.34	8
Lack of communication	0.60	2
Lack of access	0.50	4

by means of such integrated representations to recognize and arrange complications in doctors, by this means developing multiple policies beforehand it uniform happens and averting its consequences. This study in particular furnishes a critical assessment model comprising of TOPSIS in order to rank major stress variables found in doctors. The weighting of the various types of stress experienced by participants working in government and private hospitals are considered employing the AHP approach. After analysing the data, researchers conclude psychological stress to be the most prominent stress variable experienced by higher number of doctors followed by physical stress which too is second most common stress developed amongst the participants of the study. As the coronavirus has touched every country in the globe, there is little doubt that this stress is related commonly reported in other countries doctors also.

Firstly, this research's distinctive contribution is its to identify stress

variables among doctors in UP, rank those factors, and demonstrate causal links between them and also the utilization of MCDM.

- In contrast to other professions, the health care industry in India is extremely stressful, mostly due to the increased prevalence of psychological and physical discomfort.
- According to the findings, psychological stress has the most influence on how stressed-out doctors.
- It also concludes that the cultural stress is an insignificant indicator.
- Lack of balance among personal and professional life is ranked as the most important alternative decision occupational stress factor globally, while financial issues are seen as the least important.

Keeping in mind the above problems which translate into multiple stresses impacting doctors work performance, several policies must be devised and drafted to prevent doctors falling into depression. Virus like COVID-19, MERS and SARS are transforming rapidly, henceforth we should be ready for future to implement these policies if similar condition

Table 11
Assessment with other working models.

References	Model	Problem Identification
Vander-Colff et al (2013) ⁴⁶	AHP	Lack of support
Somaz and Tuglan (2003) ⁴⁷	Conventional	Lack of resources
Amole et al (2018) ⁴⁸	AHP	Lack of balance in personal life
Present work	AHP-TOPSIS	Lack of balance among personal and professional life

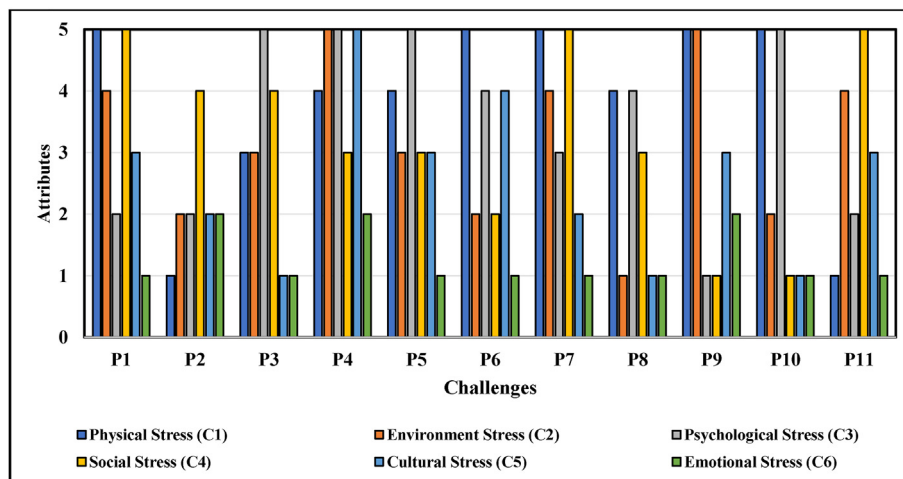


Fig. 3. Assessment of various stress models in linguistic values.

befalls again. Mutually the technical and organizations-based societies will profit from the results from this novel work. To prevent this danger, chief strategy architects such as investigators and doctors from various domains, need to come forward and identify possible measures stating appropriate recommendations for doctors by managing their workload and not exerting them beyond their capacity.

As all researches have some limitations associated with it, as it is a part of every research which can be removed in newer studies undertaken by future researchers. The current study also entails following drawbacks or limitations associated with it. Primarily, this investigation's distinctive contribution is its to recognize stress variables among doctors, rank those factors, and validate causal links between them by employment of MCDM technique. Additional research is required to determine the level to which the outcomes can be generalized and be applied to other businesses and nations. A larger sample of respondents and statistical techniques can be used in future research to confirm the study's conclusions because it only included doctors in its investigation not taking in consideration other health care workers.

The study in the end come to the conclusion that the public stress levels are an important area which should be focused and highlighted. Along with this, training requirements should be established for all types of urgent healthcare system. The government should coordinate efforts among health organizations, and other aid organizations to further develop and manage workload of doctor's network.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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