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PSYCHOMETRIC ASSESSMENT OF STRESS AND COGNITIVE FATIGUE AMONG CLINICAL PATHOLOGISTS: IMPLICATIONS FOR DIAGNOSTIC ACCURACY

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Abstract
Clinical pathologists work in high-pressure environments that demand sustained concentration, accuracy, and rapid decision-making. Continuous exposure to heavy workloads, time constraints, and emotional strain often leads to stress and cognitive fatigue, which may negatively influence diagnostic performance. This study aimed to assess the levels of stress and cognitive fatigue among clinical pathologists and examine their implications for diagnostic accuracy. A descriptive cross-sectional study was conducted among clinical pathologists working in tertiary care hospitals. Standardised psychometric tools, including the Perceived Stress Scale (PSS) and Cognitive Failure Questionnaire (CFQ), were used to evaluate stress and fatigue levels. Diagnostic accuracy was assessed through a structured simulation-based performance test. Data were analysed using appropriate descriptive and inferential statistical methods to identify trends and associations. The assessment revealed that a substantial proportion of participants experienced moderate to high stress and cognitive fatigue. Increased stress levels were associated with reduced concentration and higher error tendencies during diagnostic evaluations. Similarly, cognitive fatigue was linked to slower decision-making and decreased accuracy in diagnostic interpretations. The findings highlight that stress and cognitive fatigue significantly affect the diagnostic efficiency of clinical pathologists. Implementing targeted interventions such as workload management, rest breaks, and psychological support programs can enhance cognitive performance and ensure better diagnostic reliability in laboratory practice.
Keywords: Stress, cognitive fatigue, diagnostic accuracy, clinical pathologists, psychometric assessment

1. INTRODUCTION

The environment in which clinical pathologists work can be described as one that is characterised by constant mental activity, fast analytical thinking, and a high level of responsibility towards the accuracy of the diagnosis made. They have the daily workflow which involves the close interpretation of laboratory results, verification of the complex data, and timely informing the results that will directly affect the clinical decisions. These activities are not uncommon to be performed under constant pressure due to the large sample rates, strict turnaround periods, and the necessity to keep a high level of accuracy, compelled by the time-sensitive environment. Such demands can, in the long term, result in long-term psychological pressure, which can be in the form of stress, impaired attentional capacity, and cognitive fatigue.
The recent scientific evidence emphasises the role of stress-related disorders as a major impairment of cognitive functioning. Indicatively, people who undergo chronic stress have quantifiable decreases in memory, attention, and processing speed, which, in total, deteriorate the quality of decisions (Franke Foyen et al., 2023). Pattern recognition, detection of anomaly and evaluation of borderline diagnostic values are tasks in which these cognitive domains are necessary in laboratory medicine. As stress builds up in the mind, the pathologists will be susceptible to breakdowns in concentration, slow judgment, and inconsistencies in interpretation- elements which can predispose the pathologist to committing diagnostic errors (Frisone et al. 2021). Fatigue, in its turn, is reported to impair executive functioning, i.e. inhibitory control and mental flexibility, which are essential when conducting a complex diagnostic test (Schultz et al., 2018).In addition, the literature implies the prevalence of psychological distress in healthcare workers, as screening

instruments often reveal clinically significant amounts of stress, anxiety, and cognitive burden (Emal et al., 2023). Although these results indicate an occupational issue that is more widespread among health professionals, due to the unbroken nature of the work and the demanding accuracy of their work, clinical pathologists are particularly vulnerable (Galvez-Sánchez and Reyes del Paso, 2020). Even when automation and digital technologies are used in clinical settings to improve the efficiency of work processes, human interpretive judgments are still at the core of ambiguous laboratory results, machine hyperirritation, and interpretation of results into a consistent diagnostic story (Rezaeian et al., 2025). Hence, the cognitive health of pathologists is essential to the diagnostic reliability.

It has been revealed that stress and mental fatigue interfere with the fundamental mental functions, such as attention, working memory, and visual discrimination skills (Bartfai et al., 2021). Since accuracy in the diagnosis process depends, in part, on the ability to detect minor anomalies and combine various pieces of information, any type of cognitive violation exposes the researcher to the risk of making an error (Franke Föyen et al., 2023). The problem of diagnostic errors continues to be of great concern in the medical domain, and studies constantly associate human cognitive constraints, even in very experienced clinicians, with interpretive errors (Pesapane et al., 2024). Cognitive overload has been found to affect both accuracy and decision speed in visual pattern perception-based domains, like pathology and radiology (Satya-Murti and Lockhart, 2018; Hegde et al., 2023). These issues highlight why the impact of stress and fatigue on the diagnostic quality of clinical pathologists requires study. Fatigue is very insidious since it does not happen immediately, and it may not be detected consciously. The comparisons conducted on different fatigue-assessment instruments indicate that cognitive fatigue has the potential to affect accuracy long before individuals realise that they are showing poor performance (Kunasegaran et al., 2023). The significance of fatigue screening in healthcare is becoming more apparent due to the proven effect on diagnostic performance and clinical outcomes (Fisher et al., 2022). Likewise, cognitive load theory proposes that in cases where mental load surpasses the processing capacity of the individual, performance is impaired in both expertise-unrelated cases (Bhattacharya et al., 2025). Since pathologists usually work in stressful situations with little room to spare, the unresolved fatigue and stress can have a direct impact on patient safety (Satya-Murti and Lockhart, 2018). Additionally, it can be stated that, in addition to the knowledge of a person, the diagnostic performance depends on the cognitive conditions of the person during the interpretation as well. Neurology, dentistry, and radiology research studies reveal the consistency of cognitive stressors to reduce the accuracy of decision-making and elevate the use of heuristics or biased judgments (Greenfield et al., 2024; Goudsmit et al., 2018). The findings indicate that cognitive fatigue and stress can cause changes in interpretive behaviour in subtle but significant ways so that errors are more likely during times of overload. That is why the psychological phenomenon of clinical pathologists should be comprehended in developing safer diagnostic systems and reducing the possibility of avoidable mistakes (Gitaari et al., 2024).

Even though any psychological strain has been widely researched among healthcare workers, there has been limited research on clinical pathologists. Their mental needs are quite as different as those of other clinicians, as pathologists have to maintain high levels of visual and analytical concentration during prolonged periods of work, which in many cases occurs under isolated conditions (Khatab et al., 2024). Pathologists are prone to cognitive fatigue more than frontline clinicians since they often operate in isolated settings due to the absence of dynamism in their interaction with patients and shared environments of decision-making (Kemp et al., 2022). Moreover, the existing empirical evidence does not directly correlate psychometric indicators of stress and cognitive exhaustion with the diagnostic accuracy in the laboratory. Although several studies have investigated cognitive impairment as a result of exhaustion caused by stress (Kling et al., 2025) and extended psychological disturbances after being sick (Del Corral et al., 2024), none of them have been utilised systematically in clinical pathology (Madzar et al., 2023). Also, the majority of the literature is based on self-reported perceptions, and not objective assessment based on performance. In accordance with the recent research on stress-related disorders, objective cognitive testing can provide more credible information about the functional implications of psychological strain (Franke Foyen et al., 2023). The gap highlights the gap that requires specific studies that investigate the impact of stress and cognitive fatigue on diagnostic interpretation in clinical pathologists. This gap will help in the occupational health, laboratory quality assurance and patient safety programs.

Objectives of the Study

1. To evaluate the stress and cognitive fatigue levels of clinical pathologists with a psychometric tool.
2. To investigate the association between stress and cognitive fatigue and diagnostic accuracy under structured simulation-based evaluation.

2. MATERIALS AND METHODS

2.1 Study Design

The research design applied was a descriptive cross-sectional study design to investigate the stress levels, cognitive fatigue and diagnostic accuracy in a specified group of clinical pathologists. This design was chosen due to the possibility of measuring psychological and performance-related variables concurrently without controlling for any of the factors. The process of data collection was performed at one time, allowing the effective capture of any natural variations in stress and cognitive exhaustion. It was deemed to be a proper method to determine the relationships between psychometric indices

and diagnostic performance outcomes. This framework also helped to evaluate real-world cognitive demands to which clinical pathologists are subjected during regular practice.

2.2 Study Setting and Participants

The researchers conducted the study in the tertiary care hospital labs where clinical pathologists regularly conducted diagnostic examinations. A purposive approach was applied in the recruitment of the participants in order to represent those who are active in the practice of laboratory interpretation. The criteria used to identify eligibility were continued participation in diagnostic activities and voluntary participation. Pathologists who were not engaged in cognitive work at all were eliminated to ensure consistency in cognitive workload exposure, as were those who were absent due to long-term leave. All study participants were informed in detail about the study, and informed consent was obtained by signing a written document. The environment was also an effective reflection of the real diagnostic working situations.

2.3 Psychometric Instruments

2.3.1 Perceived Stress Scale (PSS)

The Perceived Stress Scale was used to determine the perceived stress levels of participants in the last couple of weeks. The tool was selected as it has been verified to be dependable, and it has the capability of classifying stress based on low, moderate and high levels. The respondents were directed to answer standardised items that would show their emotional and cognitive responses to their daily demands. The scores were scored based on validated standards, and thus, there was consistency in all the assessments. The PSS was filled in a low-noise surrounding to minimise any external distractors. The instrument was useful in the measurement of subjective stress perceptions in reference to the cognitive requirements of diagnostic lab practice.

2.3.2 Cognitive Failure Questionnaire (CFQ)

In the analysis of cognitive fatigue in participants, the Cognitive Failure Questionnaire was used. The reason behind the choice of this tool is that it measures the daily losses in memory, attention and performance on task elements that are directly correlated to mental fatigue. The respondents were requested to rate the degree of various cognitive challenges they encounter in day-to-day work activities. The scoring was conducted as per the laid-down protocols, in which a quantitative measure of cognitive fatigue was achieved. The CFQ was fulfilled right after the PSS in order to keep the evaluation conditions constant. This tool helped to generate significant information about cognitive strain that can affect diagnostic accuracy in clinical laboratory settings.

2.4 Diagnostic Accuracy Evaluation

A diagnostic test of interpretive performance was carried out in a structured and simulation-based test. The simulation involved standardised laboratory cases based on the haematology, biochemistry and pathology case materials, which were similar to real diagnostic tasks. All interviewees had to interpret the data presented and give diagnostic conclusions in the controlled conditions. The accuracy, the speed of making decisions, and the patterns of errors were measured with the use of a predetermined scoring system. Monitoring of the simulation was done to ensure consistency in all the assessments. This approach enabled objective determination of diagnostic performance with minimal or reduced extraneous variability that can affect the results.

2.5 Data Collection Procedure

The collection of the data was planned in the form of structured sessions to ensure that the participants were similar. All people were given the PSS, then the CFQ to complete in a quiet environment to minimise distractions and maximise dependability. Following the psychometric tests, the participants were administered the diagnostic test, which was done through simulation in the same session, to be able to capture cognitive performance at the same psychological state. The trained personnel administered all the instruments and tasks according to the standard guidelines. Data on responses and performance were recorded in a secure place and checked to ensure it was complete before being analysed. This systematic process guaranteed the reliability and validity of all the data that was gathered.

2.6 Statistical Analysis

The statistical analysis was carried out using descriptive and inferential techniques to assess the impacts of stress, fatigue, and diagnostic results. Frequency distribution, standard deviations, and mean scores were used to summarise psychometric variables. Correlation tests have been used to test the relationships between PSS and CFQ scores and diagnostic accuracy indicators. Regression analyses were done to determine the predictors of diagnostic performance whilst adjusting for the possible covariates. Any statistical analysis was done in regard to accepted analytical packages, and significance levels were set before carrying out the test. This analytic approach gave a strong conception of relationships between psychological and performance-related variables.

3. RESULTS

3.1Demographic and Professional Characteristics of the participants

The demographic and professional breakdown of the 120 clinical pathologists who participated in the study is presented in Table 1. The age distribution indicated that the majority of people were between 35 to 44 years, with smaller percentages of respondents in the younger and older ages. Professional experience of most of them ranged between 5-10 years, and then a substantial number of 11-20 years of professional experience. The patterns of daily workloads revealed that over

fifty per cent of the people had moderate workloads, with a great percentage having high-intensity workloads. In general, the table represented a varied team that was actively involved in regular diagnostic tasks.

Table 1. Participant Demographic and Professional Characteristics

Variable	Category	n (%)
Age Group (years)	25–34	32 (26.7%)
	35–44	46 (38.3%)
	45–54	29 (24.2%)
	≥55	13 (10.8%)
Years of Experience	<5 years	27 (22.5%)
	5–10 years	41 (34.2%)
	11–20 years	35 (29.2%)
	>20 years	17 (14.1%)
Daily Workload	Moderate	69 (57.5%)
	High	51 (42.5%)

3.2Distribution of levels of Stress and Cognitive Fatigue

The results of the perceived stress and cognitive fatigue in the participants. The data about stress showed that the majority of participants had a moderate level of stress, and close to a third of them had a high level of stress. Very few of them had low stress scores, as shown in Table 2. The levels of cognitive fatigue were also in the same line, as moderate fatigue was found in more than half of the sample, and high fatigue was found in almost a third. Mean scores of both variables showed of progressive increase from low to high categories. This table shows that there was a prevalence of psychological strain in the sample.

Table 2. Distribution of Stress and Cognitive Fatigue Levels

Variable	Category	n (%)	Mean Score (SD)
Perceived Stress (PSS)	Low	18 (15.0%)	11.4 (2.3)
	Moderate	67 (55.8%)	18.7 (3.1)
	High	35 (29.2%)	26.3 (4.0)
Cognitive Fatigue (CFQ)	Low	22 (18.3%)	24.6 (5.2)
	Moderate	61 (50.8%)	36.1 (6.4)
	High	37 (30.8%)	48.7 (7.1)

3.3Relationship between Stress, Fatigue and Diagnostic Accuracy

The relationship between the psychological burden and diagnostic performance was demonstrated in Table 3. Low-stressed, low-fatigued participants had the best diagnostic accuracy with the least error and the least time taken to make a decision. When stress levels went up, there was a drop in accuracy, the error rates increased, and the time of interpretation became longer. The same trend was observed in the case of cognitive fatigue, in which the highest fatigue achieved the lowest accuracy and the slowest decision-making. The results indicated that the effects of psychological strain were prominent on cognitive efficiency when performing diagnostic tasks. In general, the table demonstrated the harmful effect of stress and fatigue on the diagnosis outcomes.

Table 3. Relationship Between Stress, Fatigue, and Diagnostic Accuracy

Variable	Diagnostic Accuracy (%)	Mean Error Rate	Mean Decision Time (seconds)
Low Stress	92.4%	1.2	38.5
Moderate Stress	86.7%	2.6	45.9
High Stress	78.1%	4.3	53.7
Low Cognitive Fatigue	94.1%	1.0	36.2
Moderate Cognitive Fatigue	85.8%	2.9	47.4
High Cognitive Fatigue	76.3%	4.8	55.1

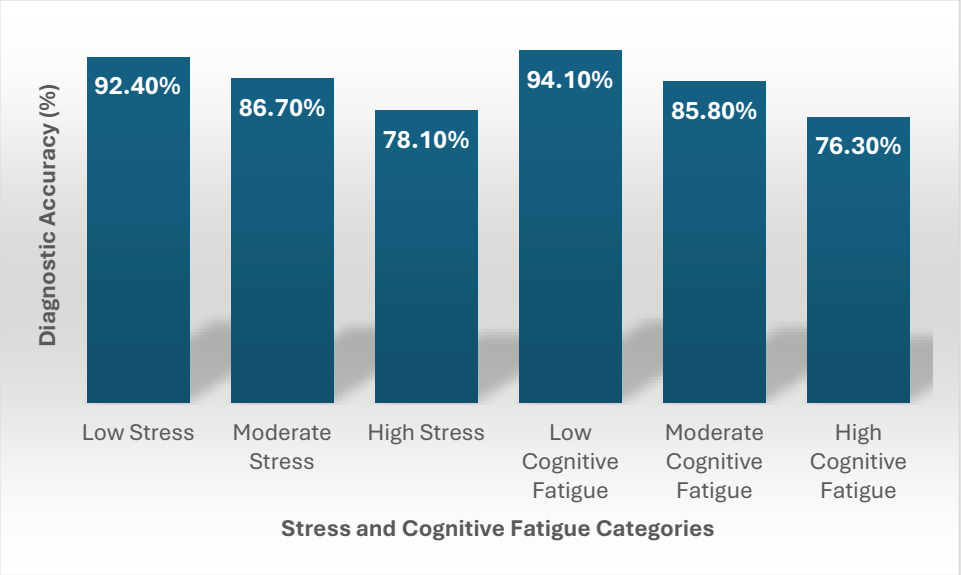

Figure 3: Interpretation of Diagnostic Accuracy Trends

The measure of diagnostic accuracy concerning levels of stress and cognitive fatigue. The tallest bars demonstrate the accuracy among those participants who were exposed to low stress and low cognitive fatigue, as shown in Figure 3. When stress escalated to high levels, there is less accuracy, and the performance of decisions became slower. The same negative pattern was recorded in cognitive fatigue, in which moderate and high fatigue led to poor accuracy. The graphical comparison revealed the evident influence of the psychological strain on the diagnostic results and the fact that the augmentation of the mental load affected the interpretative accuracy and efficiency of the response in an adverse manner.

4. DISCUSSION

The study data indicated that there was a distinct trend in which psychological strain had a high impact on the performance of clinical pathologists in terms of diagnosis. The psychometric data and performance measure results were combined and showed that the negative effects of growing stress and cognitive exhaustion on the accuracy and decision-making efficiency were stepwise. The results of this research provided valuable information on the effect of psychological strain on the performance of clinical pathologists in terms of diagnosis. Table 1 depicts the demographic profile of the study, such that the majority of respondents were mid-career workers with years of experience in diagnosing patients, an indication that the sample was a workforce that was exposed to challenging laboratory settings regularly. The trends in stress and fatigue trends as shown in Table 2, reflected that psychological strain levels ranging between moderate and high were prevalent in this group, which reflected the cognitive demands of ongoing diagnostic activity. These psychometric findings were consistent with the performance trends depicted in Table 3 and Figure 3, in which the diagnostic accuracy declined with the increase in stress and cognitive fatigue. The combination of all these findings showed a negative and stable correlation between psychological load and diagnostic efficiency. These findings were highly interpreted in favour of the idea that high levels of stress impaired cognitive function, which was necessary in terms of diagnostic precision. The high-stress participants were slower in making decisions and made more errors, which supported the theory of cognitive load, where the over-stressing of their minds led to the overloading of the attentional and working-memory capacities. This is consistent with Plessas et al. (2019), who found that time pressure, which is one of the factors of stress, had a significant negative impact on the performance of dentists in diagnosing patients. Like them, the current study established that higher pressure conditions led to the inability to make careful judgments, which led to a drop in interpretive accuracy.

The same tendency was observed concerning cognitive fatigue, which seemed to have the same negative impact on the diagnostic performance. The people with high cognitive fatigue had the lowest accuracy and the highest time to make a decision, as it is revealed in Table 3. This is in line with Fernandes et al. (2025), who stressed that mental exhaustion hampers the speed of mental processing and interferes with complicated decision-making processes. Their confirmation of the Fatigue and Altered Cognition Scale emphasised the fact that mental fatigue interferes with long-term attention- a phenomenon that was also realised in the pathologists in this study. Moreover, Galvez-Sanchez and Reyes del Paso (2020) talked about the decline in cognitive clarity in chronic fatigue, which is also found in our study, as the rates of the errors were higher in the group of highly fatigued participants.

The relationship between psychological strain and the diagnostic performance is also consistent with the general research on the association of stress with disruption occurring physiologically and cognitively. As an example, a correlation between psychological stress and sleep bruxism and proven that stress is present in physiologic reactions that may change

the day-to-day functioning. Even though the situations are different, both studies highlight the fact that stress is not just emotional, but has a great impact on cognitive efficacy. Furthermore, Rahman et al. (2016) determined that behavioural interventions enhance the functioning of individuals experiencing psychological distress, implying that the reduction of stress might result in the improvement of the diagnostic performance of the clinical setting.

These findings have significant implications for patient safety and the practice in the laboratories. The prevalence of stress and cognitive fatigue in this study is high and implies that diagnostic errors can be committed not only due to technical or procedural problems but also due to human factor vulnerability. Since the quality of clinical decisions relies on diagnostic accuracy, it becomes necessary to deal with psychological strain to ensure the quality of the laboratories. Some of the supportive strategies that institutions might require are redistributing workloads, scheduled breaks, mindfulness courses, and resilience training to alleviate stress and replenish cognitive abilities. Better scheduling and staffing would also contribute to the reduction of mental exhaustion due to the high level of workload. Also, psychometric monitoring can be integrated into the normal quality-assurance schemes to enable the detection of people at risk of cognitive overload early.

The study had a number of limitations, although it provided useful information. First, the cross-sectional design did not allow for concluding causation; although the connection was obvious, it was unclear how stress, fatigue, and performance occurred in time. Second, the tertiary care hospital laboratories were only sampled, and this might not apply to smaller or private diagnostic centres where workloads are different. Third, the evaluation of performance was conducted by the use of simulation instead of diagnostic tasks in real-time. Even though the simulation was designed to reflect real work conditions, it was not able to provide the reality and pressure of the real clinical situations. Also, the use of self-reported psychometric tools could have been subject to bias on their part, although the instruments are validated.

These limitations should be overcome in future studies by adopting longitudinal designs to enable monitoring of the changes in stress levels, fatigue and performance with time. There can also be intervention studies to investigate the effect of stress reduction or better fatigue management on improving diagnostic quality. Generalizability would be improved by extending research to cover a variety of laboratory settings. In addition, it could be beneficial to combine physiological biomarkers, like the ones employed by Karakoulaki et al. (2024), with psychometric instruments and enhance the insight into the impact of stress on cognitive processes. Lastly, pathologists-focused cognitive-support initiatives might be a valuable source of enhancing the well-being of the workforce and diagnostic safety.

5. CONCLUSION

It was established in this study that stress and cognitive fatigue were rife in clinical pathologists and that they had a strong negative impact on the diagnostic accuracy. According to the results of the psychometric tests, the levels of stress and cognitive fatigue were moderate to high, and it was observed to be prevalent in the normal laboratory practice, which indicated that there is continuous psychological pressure. The more stressed and fatigued the participants were, the slower their decision-making, the higher the error rate, and the less accurate their cognitive processes, which underscores the susceptibility of the psychological processes to stress. These findings lend support to the need to consider and deal with human-factor elements in diagnostic settings. As proper laboratory outcomes form the direct basis of clinical decision-making, the cognitive health of pathologists is critical towards patient safety and adherence to quality standards. The importance of institution-wide measures to alleviate workload, provide supportive work environments and incorporate frequent measurement of psychological strain into laboratory quality systems. Stress reduction and fatigue management interventions can be critical to the improvement of cognitive functions and diagnostic reliability. Comprehensively, this study highlighted that psychological well-being is a very imperative, but frequently ignored, aspect of diagnostic excellence. The acknowledgement of the interaction between stress and cognitive fatigue and diagnostic outcomes provides a healthcare organisation with a chance to enhance performance, minimise errors, and provide a healthier and more efficient labour force.

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