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Relationship between laboratory workload and compliance with critical value reporting procedures

Kadek Dwika Vijayanti[1]*, I Gusti Putu Agus Ferry Sutrisna Putra [2], Lia Cahya Sari [3]
[123]Medical Laboratory Technology Study Program, STIKES Wira Medika Bali, Denpasar, Indonesia
*Corresponding Author: 19025.nikadekdwikavijayanti@gmail.com

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Abstract

Reporting critical laboratory values is a vital aspect of healthcare services as it directly relates to patient safety. Compliance with standard operating procedures (SOPs) for reporting critical values is strongly influenced by various factors, including workload. This study employed an analytical observational design with a cross-sectional approach, involving all 25 laboratory personnel at BaliMed Hospital Buleleng as the sample using a total sampling technique. Data were collected through questionnaires and observation sheets, and analyzed using the chi-square test. The statistical results showed a significant relationship between workload and compliance, indicating that most respondents experienced a high workload but still demonstrated high compliance with SOPs for reporting critical values. The findings suggest that despite demanding workloads, staff maintained high procedural compliance. These results underscore the importance of institutional support in managing workload distribution to ensure sustained quality and accuracy in laboratory reporting practices. The study offers insights into optimizing laboratory performance and reinforces the relevance of workload management in strengthening procedural adherence and patient safety.

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1. Introduction

Hospitals provide comprehensive healthcare services, including inpatient care, outpatient care, and emergency services (Muliyah et al., 2020). As complex organizations, hospitals are expected to deliver high-quality services that meet patient safety standards and ensure patient satisfaction (Sumaidi et al., 2022). One of the essential components supporting medical services in hospitals is the clinical laboratory, which plays a critical role in providing objective data through specimen analysis to support diagnosis and treatment (Clavijo et al, 2021).

The quality of laboratory services heavily depends on the accuracy and timeliness of test result reporting, particularly for critical values laboratory results that fall significantly outside the normal range and require immediate clinical intervention due to their potential to endanger a patient's life (Sari, 2017). Therefore, reporting critical values must be performed promptly and following established procedures (Sari et al., 2024). Regulation of the Minister of Health of the Republic of Indonesia No. 30 of 2022 mandates that reporting critical values must occur within 30 minutes, with a compliance target of 100%. Any delay or error in reporting critical values may have fatal consequences for patient safety; thus, implementing Standard Operating Procedures (SOPs) is crucial (Riantono, 2021).

Multiple factors, including workload, influence compliance with SOPs for critical value reporting (Clavijo et al, 2021). Laboratory personnel, particularly medical laboratory technologists (MLT), are responsible not only for performing laboratory tests but also for equipment maintenance, management of

consumables, and documentation of results. High workloads can reduce concentration and increase the risk of mistakes or omissions, including those related to reporting critical values (Amalia et al., 2019a; Sari et al., 2024).

Previous studies have shown that high workload negatively correlates with SOP compliance, especially under high work pressure and limited resources (Marsetyo, 2023; Daniel, 2024). On the other hand, individual factors such as education, work experience, and knowledge also play a role in influencing laboratory personnel's adherence to SOPs (Widiawati et al., 2015; Rohani, 2008). However, no specific study has examined the relationship between workload and SOP compliance in critical value reporting at BaliMed Buleleng Hospital, even though this hospital experiences a high daily volume of laboratory visits, with suboptimal compliance levels based on preliminary observations. Therefore, this study analyzes the relationship between laboratory staff workload and compliance with Standard Operating Procedures in critical value reporting at BaliMed Buleleng Hospital. This research offers novelty by focusing on a specific local context and exploring laboratory staff's real challenges in reporting critical values. The findings will improve laboratory service quality, patient safety, and hospital managerial policy-making.

2. Method

2.1 Research Design and Participants

This study employed an analytical observational design with a cross-sectional approach, deemed appropriate for addressing the research objective: to analyze the relationship between workload and compliance with the standard operating procedure (SOP) for reporting critical laboratory values. This design allows data collection at a single point without any intervention, thereby capturing the actual conditions in the field (Moshinsky, 2021). The target population of this study comprised all laboratory personnel at BaliMed Buleleng Hospital, a total of 25 individuals, consisting of 15 full-time and 10 part-time laboratory analysts. Due to the relatively small and accessible population size, a total sampling technique was employed, meaning the entire population was included as the sample without additional selection. This technique was considered appropriate to enhance the external validity and representativeness of the research findings (Subhaktiyasa, 2024b). Inclusion criteria included laboratory personnel actively working during the data collection and willing to provide informed consent. Exclusion criteria included laboratory personnel on leave or absent during the data collection period.

2.2 Instruments and Data Collection

Data were obtained through a structured questionnaire to assess workload and an observation sheet to evaluate compliance with the SOP for reporting critical values. Primary data were obtained through structured questionnaires to assess workload and observation sheets to evaluate compliance with SOPs in reporting critical values developed based on literature synthesis. The instruments underwent validity and reliability testing. The validity test results showed that all workload and SOP compliance items were valid, with correlation coefficients (r calculated) greater than the critical value (r table = 0.373). Reliability testing showed Cronbach's Alpha values of 0.959 for the workload instrument and 0.961 for the compliance instrument, indicating excellent internal consistency (Moshinsky, 2021). Data collection was conducted in June 2025 by trained enumerators through on-site visits. Respondents were provided with an explanation of the study's objectives and asked to sign a written informed consent form. Enumerators were unaware of the study's hypotheses to minimize potential observation bias (Supriyati, 2015).

2.3 Data Analysis

The collected data were analyzed using descriptive and inferential statistical approaches with the aid of SPSS version 26. Data were checked for completeness and underwent preliminary processing such as coding and categorization. Descriptive analysis presented the frequency distribution of respondents' characteristics and study variables (Subhaktiyasaa et al., 2025). The Chi-Square test was employed for inferential analysis to examine the relationship between workload and compliance with the SOP for reporting critical laboratory values, as both variables were ordinal and categorical (Imas & Anggita, 2018). The choice of this test was based on the research objective and the nature of the data, as it does not require the assumption of normality. A p-value < 0.05 was used as the threshold for statistical significance (Moshinsky, 2021).

2.4 Ethical Considerations

This study has obtained ethical approval from the Health Research Ethics Committee of STIKES Wira Medika Bali with ethical approval number: 545/E1.STIKESWIKA/EC/VI/2025. All participants were provided with detailed information about the study's purpose and procedures and were required to sign a written informed consent form. Confidentiality and anonymity were maintained by not including personal identifiers in the publication. This study did not involve vulnerable populations or clinical trials.

3. Results and Discussion

3.1 Results

This study involved 25 laboratory staff members from BaliMed Buleleng Hospital who met the inclusion criteria and voluntarily agreed to participate. The demographic and professional characteristics assessed included age, gender, and length of employment. These variables were examined to provide a contextual overview of the respondents' backgrounds and identify potential factors influencing their workload levels and compliance with Standard Operating Procedures (SOPs) related to reporting critical values. The following sections present the distribution of respondent characteristics, the workload level experienced, the extent of SOP compliance, and the relationship between workload and compliance.

Table 1. Frequency Distribution of Respondents by Age, Gender, and Length of Employment

Category	Sub-category	Frequency	Percentage (%)
Age	20–30 years	12	48.0
	31–40 years	9	36.0
	41–55 years	4	16.0
Gender	Male	5	20.0
	Female	20	80.0
Length of Work	< 1 year	8	32.0
	1–3 years	12	48.0
	> 3 years	5	20.0

Table 1 shows that the majority of respondents were in the 20–30 years age group, totaling 12 individuals (48%), followed by nine individuals aged 31–40 years (36%), and the remaining four individuals (16%) were aged 41–55 years. In terms of gender, most participants were female (80%), while males made up 20%. Regarding length of employment, 48% of respondents had worked for 1–3 years, 32% for less than 1 year, and 20% for more than 3 years.

Table 2. Laboratory Staff Workload Levels

Category	Frequency	Percentage (%)
Light	1	4.0
Moderate	6	24.0
Heavy	18	72.0
Total	25	100.0

Table 3. SOP Compliance Levels

Category	Frequency	Percentage (%)
Non-compliant	2	8.0
Compliant	23	92.0
Total	25	100.0

Table 2 indicates that most laboratory staff at BaliMed Buleleng Hospital experienced a heavy workload, with 72% of respondents falling into this category. Meanwhile, 24% experienced a moderate workload, and only 4% reported a light workload. Table 3 demonstrates that the most laboratory staff demonstrated high compliance with the SOP for reporting critical values, with 92% of respondents classified as compliant and only 8% as non-compliant.

Table 4. Relationship Between Workload and SOP Compliance

Workload	SOP Compliance		Total	p-value
	Non-compliant	Compliant		
Light	0 (0,0%)	1 (4,0%)	1 (4,0%)	0.032
Moderate	2 (8,0%)	4 (16,0%)	6 (24,0%)	
Heavy	0 (0,0%)	18 (72,0%)	18 (72,0%)	
Total	2 (8,0%)	23 (92,0%)	25 (100,0%)	

Table 4 shows that among 25 respondents, all 18 individuals (72%) with a heavy workload complied with the SOP. Meanwhile, among those with a moderate workload (6 people or 24%), four were compliant and two were non-compliant. The only respondent with a light workload (4%) also complied with the SOP. No non-compliance was observed in either the light or heavy workload groups. These results indicate that SOP compliance tended to be higher among those with a heavy workload, while non-compliance was only observed in the moderate workload group. It is supported by the Chi-Square test, which yielded a significance value of $p = 0.032$, indicating a statistically significant relationship between workload and SOP compliance.

3.2 Discussion

This study aimed to examine the workload of laboratory staff, their compliance with Standard Operating Procedures (SOPs) in reporting critical laboratory values, and the relationship between workload and SOP compliance at BaliMed Buleleng Hospital. The findings confirm the study hypotheses and offer significant insights into how individual and organizational characteristics influence work performance in laboratory healthcare settings. The first key finding reveals that most laboratory staff (72%) perceived their workload as heavy. It supports the assumption that workload in clinical laboratories remains high, which aligns with Robbins' (2001) theory of Human Resource Management. According to this theory, stress and reduced performance are likely outcomes when job demands exceed an individual's physical and mental capabilities. Supporting literature echoes these results. A study by Oktaviola et al. (2022) on nursing staff reported that 73.7% experienced heavy workloads, while Rahmadi et al. (2022) found a similar trend. These findings confirm that high workload is a common issue in healthcare institutions, potentially linked to staffing, work schedules, and task distribution inefficiencies (Darma et al, 2021). However, this result contrasts with Erviana (2024), who found that 66.7% of Emergency Department staff experienced light workloads. This discrepancy stems from contextual differences such as healthcare unit type, patient volume, and systemic organization. In the present study, most respondents were aged 20–40 and had worked for less than three years (Nurhasanah & Gunawan, 2021). Although this age group typically has high physical stamina, limited experience may reduce their efficiency, causing them to perceive the workload as heavier (Don-Wauchope et al, 2024). Furthermore, the predominance of female staff (80%) might influence how workload is experienced, especially when external responsibilities, such as household duties, intersect with professional demands, a pattern supported by Kwak et al. (2021).

In addressing the second research objective, the study found that 92% of respondents complied with SOPs related to reporting critical laboratory values. This finding supports the Total Quality Management (TQM) framework, which emphasizes standardization, discipline, and consistency as foundations for improved service quality and patient safety (Goetsch & Davis, 2021). Accurate and timely critical value reporting is vital in avoiding clinical delays, and the high compliance rate observed indicates a well-functioning quality assurance culture at BaliMed Hospital. These findings are consistent with Li et al. (2022), who reported that compliance increased to 94% after implementing a closed-loop notification system. Similarly, Rosita and Edy (2020) documented that 99% of critical values were reported within the 10-minute target, showing how systems and procedural clarity can enhance adherence. In contrast, Utami et al. (2021) found persistent delays in reporting prior to system intervention, emphasizing the importance of infrastructure and staff training in ensuring SOP compliance.

The study's demographic profile provides additional insight into the compliance rates. Most respondents were in the early stages of their careers and likely more receptive to guidance, training, and feedback. It resonates with González-González et al. (2019), who emphasized the importance of early-career socialization in fostering professional discipline. Thus, the findings suggest that even relatively

inexperienced staff can achieve high compliance with clear procedures and supportive supervision (Ekaputra, & Fatmawati, 2022).

The third major finding indicates a statistically significant relationship between workload and compliance with SOPs in reporting critical laboratory values. It reinforces the idea that while a high workload is often perceived negatively, it may foster a heightened sense of responsibility and discipline when staff recognize the importance of their tasks. Wickens et al. (2016) argue that workload within acceptable limits can increase performance by stimulating cognitive engagement and vigilance. This result is in line with Efendy and Hutahaean (2022), who found a significant relationship between workload and compliance among hospital staff, as well as Supratti et al. (2024) and Sari et al. (2022), who demonstrated similar findings in various healthcare settings. These studies suggest that, in healthcare, increased demands may lead to greater adherence when proper support structures exist. However, not all literature aligns. Imron et al. (2022) found no significant association between workload and hand hygiene compliance among nurses, indicating that task specificity and context play important roles in moderating this relationship.

In this study, the dominant age group (20–30 years) and relatively short work tenure (1–3 years) suggest that respondents were still in a formative phase of their careers, likely experiencing high motivation to perform well and demonstrate professional responsibility (Irvianti & Verina, 2015). These findings contribute to the broader discourse on laboratory performance by emphasizing the role of contextualized workload management and structured SOP implementation in promoting compliance, especially among early-career staff (Jafari et al, 2021; Komalasari & Martha, 2023; Koto & Munandar, 2019). The insights gained are valuable for clinical supervisors and hospital administrators in designing onboarding programs (Malik et al, 2020), mentoring systems, and workload distribution strategies that minimize error risk while enhancing procedural adherence (Kuo et al, 2021; Fernández, 2023; Sinaga & Pohan, 2021).

4. Conclusion

This study highlights the dynamic relationship between laboratory staff workload and compliance with standard procedures for critical value reporting. Despite considerable workloads, most BaliMed Buleleng Hospital personnel consistently adhere to SOPs, indicating that professional commitment and institutional protocols can effectively support performance under operational pressures. The findings contribute to a deeper understanding of how workload influences procedural discipline within clinical laboratory environments. This study emphasizes the importance of managing workload and reinforcing SOP implementation to ensure timely and accurate reporting of critical laboratory values, which are essential for patient safety and clinical decision-making. The results are particularly relevant for laboratory administrators in resource-limited settings, providing insights into workforce management and quality assurance. However, limitations such as the single-site design and small sample size may limit the generalizability of the findings. Future research should include multicenter studies with broader participant diversity to explore mediating factors such as supervision quality, workflow systems, or professional training that may influence compliance. These efforts will inform improved policies and practices in laboratory quality management and service delivery.

Conflict of Interest

The authors declare no conflict of interest.

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