Original Article

Factors Influencing Patient Perception of Clinical Laboratory Services: A Cross-Sectional Study

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ABSTRACT

Background: Hospital clinical laboratories are essential for diagnosis, treatment monitoring, and clinical decision-making, and increasingly contribute to hospital revenue. However, in contrast to high-income settings where laboratory service quality has been more extensively studied, there is still limited empirical evidence from low- and middle-income countries (LMICs), including Indonesia, on how structural and process-related aspects of private hospital clinical laboratory services shape patient perceptions. This study aimed to analyze factors associated with patient perceptions of clinical laboratory services.

Methods: This quantitative cross-sectional study. A total of 114 consecutively recruited patients completed the Clinical Laboratory Service Perception Questionnaire (CLSPQ), a 22-item validated instrument covering education level, physical environment (laboratory room, cleanliness of rooms and toilets, waiting area comfort), service processes (waiting time, availability of tests, clarity of information), and overall perception of laboratory services. Data were analyzed using chi-square tests and multiple logistic regression to identify independent predictors of positive patient perceptions ($p < 0.05$).

Results: In multivariable analysis, higher education level, bright and hygienic laboratory rooms, comfortable and clean waiting areas, clear information about laboratory services, very clean laboratory rooms, clean and odorless toilets, shorter waiting times, and availability of all required laboratory tests were independently associated with positive patient perceptions of clinical laboratory services (all $p < 0.001$). Laboratory cleanliness showed the strongest association with positive perceptions, followed by toilet cleanliness and shorter waiting times.

Conclusion: Physical environmental conditions and key service delivery processes are major determinants of how patients perceive clinical laboratory services in this LMIC private hospital. Prioritizing low-cost improvements in cleanliness, waiting room comfort, queue management, and clarity of information within continuous quality improvement programmes may substantially enhance patient satisfaction and strengthen the professional image of hospital laboratories in similar resource-limited settings.

Keywords: hospitals; clinical laboratory services; patient perception; patient satisfaction; service quality.

Implications for Practice:

- In resource-limited LMIC hospital settings, enforcing simple but consistent standards for cleanliness and comfort in laboratory rooms, toilets, and waiting areas can yield substantial improvements in patient perceptions at relatively low cost.
- Implementing basic queue management strategies (such as appointment systems, numbered queues, and clear communication of expected waiting times) is a feasible way to reduce waiting time and enhance the patient experience of clinical laboratory services in busy outpatient departments.
- Hospital managers in LMIC private hospitals can integrate patient feedback on the physical environment, waiting time, and clarity of information into routine continuous quality improvement and policy decisions to prioritise realistic, high-impact interventions in clinical laboratories

Introduction

Hospital laboratory services are a vital component of health systems because they directly support diagnostic processes, therapy monitoring, and clinical decision-making. Globally, high quality laboratory services have been shown to improve diagnostic speed, treatment accuracy, and patient satisfaction (WHO, 2023). However, international reports continue to highlight gaps in laboratory service quality, particularly regarding waiting times, environmental cleanliness, and staff–patient interactions, which undermine public trust in healthcare institutions (Singh et al., 2021; Zhang et al., 2022).

In many high-income countries, laboratory services are supported by mature quality management systems, accreditation programmes, and stable human-resource and infrastructure investments, leading to relatively standardised patient experiences (Deger et al., 2024; Hosseinzadeh et al., 2024). By contrast, laboratories in low- and middle-income countries (LMICs) frequently operate under resource constraints, with overcrowded facilities, limited space for waiting areas, and variable staffing levels. These contextual differences may amplify the influence of basic structural conditions such as cleanliness and seating capacity on patient perceptions compared with high-income settings (Abebe et al., 2023; Hossen et al., 2023). Nonetheless, empirical studies examining patient perceptions of clinical laboratory services in LMIC private hospitals remain scarce, especially in rapidly industrialising areas such as Cikarang, Indonesia.

Nationally, hospital laboratories in Indonesia function not only as diagnostic support units but also as important revenue centres that contribute to hospital operational efficiency (Santoso, 2018). Previous studies have reported generally high satisfaction with laboratory services but also recurrent complaints about room cleanliness, waiting room comfort, and staff attitudes (Fatmawati & Yuliana, 2021; Levana et al., 2022; Pamuji, 2018). Some studies have highlighted the role of environmental hygiene and waiting time as dominant determinants of patient satisfaction, whereas others have emphasised socio-demographic characteristics or staff communication as more influential factors (Manzoor et al., 2019; Shie et al., 2022; Thanh et al., 2022). These inconsistent findings suggest that the relative importance of structural, process, and patient-related factors may vary across settings and remain insufficiently understood in Indonesian private hospitals.

From a theoretical perspective, this study draws on Service Quality (SERVQUAL) theory and Donabedian's structure–process–outcome model. Donabedian conceptualises healthcare quality as a function of structure (e.g., physical facilities, equipment, and human resources), process (e.g., service delivery and staff-patient interactions), and outcomes (e.g., patient perceptions and satisfaction). In this study, structural factors

include laboratory room conditions (brightness and hygiene), cleanliness of laboratory rooms and toilets, and waiting room comfort; process factors include perceived waiting time, clarity of information about laboratory procedures, and availability of required laboratory tests; and the outcome is the overall patient perception of clinical laboratory service quality. Within the SERVQUAL framework, these structural and process variables correspond primarily to the tangibles, responsiveness, reliability, and assurance dimensions that shape patients' evaluations of service encounters (Basri, 2021; Kotler & Keller, 2016).

From a nursing and health management perspective, understanding which structural and process elements most strongly influence patient perceptions in LMIC private hospitals is essential for designing feasible, high-impact quality improvement strategies. Evidence from outpatient and inpatient settings suggests that modest investments in cleanliness, information systems, and queue management may substantially improve patient experience (Cai et al., 2025; Fatmawati & Yuliana, 2021; Levana et al., 2022; Rahmatia et al., 2025). However, there is still limited quantitative evidence linking specific environmental and process factors to patient perceptions of clinical laboratory services in Indonesian private hospitals, and little is known about how these relationships manifest in industrial urban areas such as Cikarang.

Therefore, this study aimed to identify and analyse factors associated with patient perceptions of clinical laboratory services at Sentra Medika Cikarang Hospital. Specifically, the objectives were: (1) to describe patient perceptions of clinical laboratory services using a structured questionnaire, and (2) to determine which structural (environmental and cleanliness) and process-related (waiting time, information, availability of tests) factors are independently associated with positive patient perceptions using multivariable logistic regression. These measurable objectives provide an empirical test of the relevance of Donabedian's and SERVQUAL frameworks in an LMIC private hospital context.

Methods

Study Design

This quantitative study employed a cross-sectional design. The independent variables (potential influencing factors) and the dependent variable (patient perception of clinical laboratory services) were measured simultaneously at one point in time. The cross-sectional design was chosen because it allows efficient estimation of the prevalence of positive perceptions and exploration of associations between multiple structural and process variables and patient perceptions under routine service conditions, which is particularly suitable for busy LMIC hospital laboratories where follow-up is difficult (von Elm et al., 2007). The study was conducted at Sentra Medika Cikarang Hospital, a private general hospital located in Cikarang, West Java, Indonesia. Data collection took place in the hospital's clinical laboratory between June and September 2025. Reporting follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies (von Elm et al., 2007).

Participants

The study population comprised all patients who received clinical laboratory services at Sentra Medika Cikarang Hospital during the study period (N = 650). The target sample was outpatients who had completed the clinical laboratory service process on the day of their visit. An accidental (convenience) sampling approach was used because no complete

sampling frame of daily laboratory users was available, and the study aimed to capture typical patient experiences during routine service hours, a strategy that is commonly used in LMIC outpatient satisfaction studies (Abebe et al., 2023; Hossen et al., 2023).

Inclusion criteria were: (1) age ≥18 years; (2) completion of the full clinical laboratory service process (registration, specimen collection, use of laboratory facilities, and receipt or notification of test results); and (3) ability to understand and complete the questionnaire independently or with minimal assistance. Exclusion criteria were: (1) refusal to participate; (2) critical clinical condition or severe distress; and (3) inability to complete the questionnaire.

Each day, trained enumerators identified patients who had just completed their clinical laboratory visit from the laboratory register and approached them consecutively in the waiting or results area. After verifying eligibility, enumerators provided a brief explanation of the study and invited patients to participate. Patients who agreed signed written informed consent and self-completed the questionnaire, with assistance provided only for clarifying questions. During daily data collection, all eligible patients who were approached were invited to participate; those who declined were thanked and not included in the study, whereas those who agreed and completed the questionnaire formed the final sample. In total, 114 patients met the inclusion criteria, consented to participate, and completed the questionnaire; these respondents constituted the final analytic sample. The number of patients approached and declining participation was not systematically recorded, which precluded calculation of a precise response rate and is acknowledged as a limitation.

The minimum required sample size was calculated using the finite population correction formula $n = N / (1 + N \cdot d^2)$, where N is the population size (650) and d is the desired precision (8%). Based on this calculation, the minimum sample size was 114 respondents, which was achieved in the study (Sugiyono, 2018).

Instruments

Patient perceptions of clinical laboratory services were measured using a structured, closed-ended questionnaire developed for this study, hereafter referred to as the Clinical Laboratory Service Perception Questionnaire (CLSPQ). The CLSPQ was designed to capture sociodemographic characteristics and multiple domains of laboratory service quality: respondent education level, laboratory room conditions, waiting room comfort, information about laboratory services, cleanliness of laboratory rooms and restrooms, queue times, and availability of laboratory test types.

The initial pool of items was developed based on indicators of service quality in quantitative survey research (Sugiyono, 2018) and previous studies on clinical laboratory service quality and patient satisfaction in hospital settings (Fatmawati & Yuliana, 2021; Levana et al., 2022; Pamuji, 2018; Santoso, 2018). Content validity was assessed by an expert panel consisting of three specialists in hospital management, health research methodology, and clinical laboratory services, who independently evaluated each item for relevance, clarity, and completeness.

The CLSPQ was originally developed in Bahasa Indonesia. For the purposes of this manuscript, an English version was produced using a forward-backward translation procedure: two independent bilingual translators translated the items from Bahasa Indonesia into English, a third translator back-translated the English

version into Bahasa Indonesia, and discrepancies were resolved by consensus among the research team to preserve conceptual meaning. All psychometric testing reported in this study pertains to the original Bahasa Indonesia version administered to participants.

Construct validity was examined using item–total correlation; items with item–total correlation coefficients greater than 0.30 were retained. Internal consistency reliability assessed by Cronbach's alpha for the overall instrument was 0.87, indicating very good reliability. Each item used a 5-point Likert scale with response options ranging from 1 ("strongly disagree") to 5 ("strongly agree"), where higher scores indicate more positive perceptions of the corresponding aspect of laboratory services. For descriptive interpretation, scores were converted into percentage categories: very low (0–20%), low (21–40%), moderate (41–60%), high (61–80%), and very high (81–100%).

Table 1 summarises the components of the CLSPQ, the number of items in each domain, the response scale, and reference sources. The full version of the CLSPQ is provided in Appendix 1 (Clinical Laboratory Service Perception Questionnaire).

Table 1. Summary of Instrument Components

Measured Components	Number of Items	Scale	Reference Source	Description
Laboratory room conditions	5 items	Likert scale 1–5	adapted from Sugiyono (2018) and researcher modification	Measures perceptions of physical facilities and comfort
Waiting room comfort	4 items	Likert scale 1–5	Researcher modification	Measures comfort while waiting for test results
Laboratory information	3 items	Likert scale 1–5	adapted from Sugiyono (2018)	Assesses clarity and availability of information about clinical laboratory services
Laboratory and restroom cleanliness	4 items	Likert scale 1–5	Researcher modification	Measures perceptions of cleanliness and hygiene
Queue time	3 items	Likert scale 1–5	adapted from Sugiyono (2018),	Assesses perceived service efficiency
Availability of test types	3 items	Likert scale 1–5	Researcher modification	Measures perceived completeness and accessibility of available clinical laboratory tests
Total Items	22 items			

Data Collection

Data collection was conducted at Sentra Medika Cikarang Hospital from June to September 2025. Primary data were obtained directly from respondents using the CLSPQ. The principal investigator was assisted by trained enumerators who approached eligible patients after they had completed their clinical laboratory services, as described above.

Enumerators participated in a structured half-day training prior to data collection. The training covered the study objectives, ethical principles, inclusion and exclusion criteria, standardised scripts for approaching potential participants, procedures for obtaining informed consent, and step-by-step instructions for administering and checking the questionnaire. Role-plays were used to ensure consistent communication and to minimise interviewer bias.

The operational workflow for data collection comprised the following steps: (1) daily identification of patients who had completed laboratory services; (2)

eligibility screening based on inclusion and exclusion criteria; (3) invitation to participate and provision of information sheet; (4) signing of written informed consent; (5) self-completion of the questionnaire in a designated waiting area; (6) immediate review of the completed questionnaire by the enumerator for completeness; and (7) secure storage of completed questionnaires in a locked folder. When missing responses were identified at the time of checking, enumerators politely asked respondents whether they were willing to complete the unanswered items; respondents could decline without consequence.

Completed questionnaires were checked daily by the principal investigator for completeness and internal consistency. Questionnaires with irreconcilable missing responses or inconsistencies would have been excluded; however, this was not necessary because all 114 questionnaires included in the analysis were complete. Paper questionnaires were stored in a locked cabinet, and data were entered into a password-protected electronic database.

Data Analysis

Data analysis was performed using IBM SPSS Statistics version 23. Descriptive (univariate) analyses were used to summarise the frequency and percentage distributions of sociodemographic characteristics, CLSPQ item responses, and overall perception categories.

For inferential analysis, bivariate associations between each independent variable and the dependent variable (overall patient perception of clinical laboratory services, categorised as positive versus less positive) were examined using chi-square tests. Following common practice in multivariable modelling, variables with p-values < 0.25 in bivariate analysis were retained as candidates for inclusion in the multivariable logistic regression model to avoid prematurely excluding potentially important predictors (Manzoor et al., 2019; Thanh et al., 2022). Multiple logistic regression with stepwise selection was then used to identify independent predictors of positive patient perceptions. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated, and statistical significance was set at $p < 0.05$; p-values < 0.001 are reported as $p < 0.001$.

Prior to logistic regression, assumptions were assessed. Multicollinearity was evaluated using variance inflation factor (VIF) values, and no problematic multicollinearity was detected. Model fit was assessed using the Hosmer–Lemeshow goodness-of-fit test; non-significant p-values indicated adequate model fit. Because all questionnaires used in the analysis were complete, no imputation procedures for missing data were required. However, some categories had small cell counts, resulting in very large ORs for a few predictors (e.g., laboratory cleanliness). In line with recommendations for handling sparse data bias, these extreme OR values are interpreted qualitatively as indicating very strong associations rather than as precise effect size estimates, and this issue is revisited in the Discussion.

To minimise data entry errors, data were double-entered by two independent data entry staff and compared; any discrepancies were resolved by checking the original paper questionnaires.

Ethical Considerations

This study received ethical approval from the Health Research Ethics Committee, Faculty of Health Sciences, Universitas Medika Suherman (Ethical Clearance No. 003613/UNIVERSITAS MEDIKA SUHERMAN/2025), issued on 14 July 2025. Prior to data collection, all potential participants were informed about the study's objectives, procedures, potential

risks and benefits, and data confidentiality. Patients who agreed to participate signed a written informed consent form. Participation was entirely voluntary, and respondents could withdraw at any time without consequences for their care. Anonymity and confidentiality were ensured by using unique codes instead of personal identifiers and by storing data securely.

Results

Table 2 shows the sociodemographic characteristics of the 114 respondents included in the study. Respondents represented a range of age groups, both male and female patients, diverse educational backgrounds, various employment categories, and different payment mechanisms (self-paying and insurance). These characteristics provide an overview of the patient population using clinical laboratory services at Sentra Medika Cikarang Hospital during the study period.

Table 2. Sociodemographic Characteristics

Characteristic	Category	n	%
Age (years)	Younger (< 21 years)	14	12.3
	Adult (21–55 years)	91	79.8
	Older (> 55 years)	9	7.9
Gender	Male	45	39.5
	Female	69	60.5
Education level	Low (primary and junior high school)	10	8.8
	Middle (senior high school, diploma 1–2)	72	63.2
	High (diploma 3, bachelor's degree)	32	28.1
Occupation	Not working (housewife, student)	26	22.8
	Non-permanent worker (self-employed, temporary)	18	15.8
	Employee (government or private sector)	70	61.4
Payment type	Employer-paid	17	14.9
	Insurance-paid	31	27.2
	Self-paying	66	57.9

Sociodemographic characteristics of the 114 respondents are presented in Table 2. Most patients were adults aged 21–55 years (79.8%) and female (60.5%). The majority had middle education (63.2%) and worked as government or private employees (61.4%). More than half of the examinations were self-paid (57.9%), while the rest were covered by insurance (27.2%) or employer schemes (14.9%). These characteristics should be considered when interpreting the factors associated with patient perceptions of clinical laboratory services.

Item-level descriptive analysis

Item-level descriptive statistics for the 22 CLSPQ items showed generally favourable perceptions across most aspects of clinical laboratory services. For structural items, the majority of respondents agreed or strongly agreed that the laboratory room was bright and hygienic and that the toilets were clean and odorless. However, a relatively higher proportion of neutral or less positive responses was observed for items related to waiting time and seating capacity in the waiting area, suggesting that these aspects of the service environment remain areas for improvement.

Stage I Analysis: Bivariate Selection

Table 3 presents the results of the bivariate analysis between each independent variable and patient perception of clinical laboratory services. Variables with p-values < 0.25 were selected as candidates for multivariable analysis.

Table 3. Independent Variables with p-values < 0.25 in Bivariate Analysis

Variable	p-value	OR / Exp(B)
Respondent's education	0.001	0.279
The laboratory room is bright and hygienic	< 0.001	18.778
The waiting area is comfortable and clean	< 0.001	8.624
The number of seats is adequate	0.143	3.300
Services are provided politely and courteously	0.094	3.814
Information about the laboratory is provided clearly	< 0.001	11.451
The laboratory room is very clean	< 0.001	898.852
Toilet is clean and odorless	< 0.001	63.624
Waiting time is not long	< 0.001	29.225
All types of laboratory tests are available	< 0.001	12.753

Variables with p-values ≥ 0.25 in bivariate analysis, such as age (p = 0.343), gender (p = 0.679), and occupation (p = 0.261), were not included in the multivariable model.

Stage II Analysis: Multivariable Modeling

Table 4 shows the results of the multiple logistic regression analysis examining independent predictors of positive patient perceptions of clinical laboratory services.

Table 4. Independent Predictors of Positive Patient Perception of Clinical Laboratory Services

Variable	p-value	OR / Exp(B)
Respondent's education	0.001	0.279
The laboratory room is bright and hygienic	< 0.001	18.778
The waiting area is comfortable and clean	< 0.001	8.624
Information about the laboratory is provided clearly	< 0.001	11.451
The laboratory room is very clean	< 0.001	898.852
The toilet is clean and odorless	< 0.001	63.624
Waiting time is not long	< 0.001	29.225
All types of laboratory tests are available	< 0.001	12.753

All variables in **Table 4** showed a statistically significant relationship with patient perception of clinical laboratory services (p < 0.001). Laboratory cleanliness exhibited the highest OR, indicating a very strong association with positive patient perceptions. Clean and odorless toilets, shorter waiting times, and the availability of all required laboratory tests also had large ORs, highlighting the importance of these structural and process factors in shaping patient perceptions. The very high OR for "laboratory room is very clean" likely reflects highly skewed response patterns and should be interpreted with caution.

Figure 1 illustrates the conceptual model summarising the relationships between structural factors, process factors, and patient perception of clinical laboratory services.

Figure 1. Conceptual model of structural and process factors influencing patient

perception of clinical laboratory services based on Donabedian's framework.

Discussion

This study examined factors associated with patient perceptions of clinical laboratory services at a private general hospital in an industrial area of Indonesia. The main finding was that structural aspects—particularly laboratory cleanliness, toilet cleanliness, waiting room comfort, and bright and hygienic laboratory rooms—together with process-related aspects such as waiting time, clarity of information, and availability of laboratory tests were strongly associated with positive patient perceptions. In addition, patient education level was independently related to perception, with more educated patients being more critical of service quality.

These results are consistent with the service quality framework proposed by Parasuraman, Zeithaml, and Berry, which emphasises the importance of tangibles, reliability, and responsiveness in shaping customer perceptions (Basri, 2021). In the present study, tangibles were operationalised through physical environmental factors (cleanliness, brightness, comfort), responsiveness through waiting time and communication, and reliability through the availability of required tests. The strong associations observed for environmental cleanliness and waiting time align with previous work showing that these dimensions are key determinants of patient satisfaction in hospital laboratories and outpatient services (Fatmawati & Yuliana, 2021; Levana et al., 2022; Zhang et al., 2022). From a marketing perspective, Kotler and Keller's concept of "service encounter quality" also supports the interpretation that patients evaluate service quality not only based on technical outcomes but also on their experiences during service encounters, including the conditions in which they wait for and receive services (Kotler & Keller, 2016).

The very high OR for laboratory cleanliness and the large ORs observed for toilet cleanliness and shorter waiting times suggest that these factors are perceived by patients as non-negotiable requirements for acceptable quality. However, these extreme OR values likely reflect sparse data in some categories (e.g., very few respondents reporting poor cleanliness) and should therefore be interpreted qualitatively as indicating very strong associations rather than precise numerical estimates of effect size. This pattern is similar to other studies of patient satisfaction where key environmental variables demonstrate large ORs due to limited variability in responses (Abebe et al., 2023; Singh et al., 2021).

The finding that more educated patients were more critical of services is consistent with Manzoor et al. (2019), who reported that higher education is associated with increased expectations and more discerning evaluations of healthcare quality. In the context of this study, patients with higher education may have greater exposure to information about standards of care or experience with health facilities in other settings, making them more sensitive to deficiencies in physical environment, communication, or waiting time.

Demographic characteristics such as age, gender, occupation, and payment type were not significantly associated with patient perceptions in this setting. This contrasts with some studies that have reported associations between demographic factors and satisfaction (Shie et al., 2022; Thanh et al., 2022) but supports other findings where structural and process factors overshadow individual characteristics when variation in the physical environment and service efficiency is marked (Hossen et al., 2023). These

discrepancies highlight that the relative importance of demographic versus service-related factors may vary across contexts and underscore the need for local empirical data to inform quality improvement priorities.

Viewed through Donabedian's structure–process–outcome model, the findings of this study reinforce the central role of structural and process elements in shaping patient-perceived outcomes. The structure component in this study encompasses laboratory room conditions, waiting room comfort, and the cleanliness of laboratory rooms and toilets; the process component includes waiting time, clarity of information, and the availability of required tests; and the outcome is patient perception of laboratory service quality. The strong associations between structural and process variables and patient perceptions provide empirical support for the hypothesis that improvements in basic infrastructure and workflow can translate into better perceived outcomes even without major technological changes.

This study also contributes to the literature by providing evidence from an LMIC private hospital in an industrial urban area—an underrepresented setting in the patient satisfaction literature. In contrast to many studies conducted in public hospitals or primary care facilities, this study shows that even private hospitals operating under resource constraints can face challenges related to crowding, environmental maintenance, and communication. The findings suggest that relatively low-cost interventions, such as strengthening cleaning routines, providing adequate seating and ventilation, and improving queue management systems, may have a disproportionate impact on patient perceptions in LMIC laboratories. At the same time, the results highlight that more complex interventions, such as electronic queue systems or integrated information displays, may be warranted as resources permit, particularly in industrial regions with high patient volumes.

Finally, the study extends theoretical understanding by operationalising SERVQUAL and Donabedian's frameworks using a context-specific instrument (the CLSPQ) and demonstrating that structural and process variables aligned with the tangibles, responsiveness, reliability, and assurance dimensions are strongly linked to perceived service quality. Future research could further refine this instrument, evaluate its performance in other hospital types, and explore additional outcome measures such as loyalty intentions or complaint behaviour.

Implications and limitations

Conceptually, the findings of this study reinforce the relevance of the SERVQUAL framework and Donabedian's model for understanding patient perceptions of clinical laboratory services in LMIC private hospitals. By demonstrating that specific structural elements (e.g., toilet cleanliness, waiting room comfort) and process elements (e.g., waiting time, clarity of information, availability of tests) are strongly associated with perceived service quality, the study clarifies which tangibles and process attributes should be prioritised when translating these theoretical models into measurable quality indicators.

Practically, the results highlight several priorities for hospital managers and clinical leaders. First, environmental hygiene standards for clinical laboratories and surrounding facilities should be clearly defined, effectively communicated to cleaning and support staff, and regularly audited using simple checklists. Second, queue management strategies, including appointment systems, numbered queues, and clear communication of expected waiting times, should be implemented to reduce perceived and actual waiting times.

Third, information about clinical laboratory procedures, preparation requirements, and result collection should be communicated in plain language, using verbal explanations supported by visual media such as posters or digital displays that are accessible to patients with different educational backgrounds. Fourth, patient feedback on environmental conditions, waiting time, and communication should be routinely collected and integrated into continuous quality improvement (CQI) programmes and staff performance evaluations, particularly in resource-limited LMIC settings.

This study also has several limitations that should be considered when interpreting the findings. The cross-sectional design precludes causal inference; associations between structural and process factors and patient perceptions cannot be interpreted as causal relationships. The study was conducted in a single private hospital in an industrial area of West Java with a relatively small sample size, which limits the generalisability of the findings to other hospital types and regions. The use of accidental (non-probability) sampling and the absence of a systematically recorded denominator of eligible patients mean that a formal response rate could not be calculated; selection bias is therefore possible if patients with stronger opinions about the laboratory were more likely to participate. Patient perceptions were measured using self-administered questionnaires, which may be affected by social desirability bias or transient emotional states at the time of completion. Finally, some predictors produced very large ORs due to sparse data in certain response categories; these estimates should be interpreted as signals of strong association rather than precise quantifications of effect size.

Relevance to Practice

The findings of this study have direct implications for practitioners and hospital managers seeking to improve the quality of clinical laboratory services in LMIC private hospitals. In this context, environmental cleanliness, efficient waiting times, and clarity of information emerged as key determinants of how patients appraise service quality. Clinical and non-clinical staff should therefore work collaboratively to maintain high standards of cleanliness in laboratory rooms and restrooms through clear protocols and regular monitoring; ensure that waiting areas are comfortable, adequately ventilated, and equipped with sufficient seating; implement transparent and efficient queue systems that minimise waiting and provide realistic information about expected waiting times; and communicate laboratory procedures empathetically in language that patients with diverse educational backgrounds can understand. Embedding these practices into hospital policies, standard operating procedures, and CQI initiatives can help foster a patient-centred culture, improve perceived quality of laboratory services, and enhance the hospital's reputation in the community despite resource limitations.

Conclusion

In this private hospital laboratory in an industrial area of Indonesia, patient perceptions of clinical laboratory services were strongly influenced by structural factors—particularly laboratory and toilet cleanliness, waiting room comfort, and bright and hygienic laboratory rooms—as well as process-related factors such as waiting time, clarity of information, availability of tests, and patient education level. These findings support the relevance of service quality theory and Donabedian's structure–process–outcome framework by showing that tangible environmental conditions and key aspects of service

delivery are central to how patients evaluate laboratory services. Improving the quality of clinical laboratory services in similar LMIC settings therefore requires not only technical competence but also systematic attention to environmental management, queue and workflow organisation, and patient-centred communication. Integrating these priorities into continuous quality improvement programmes offers a practical pathway for hospitals to develop clinical laboratory services that are professional, clean, and responsive to patient expectations.

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CrediT Authorship Contributions Statement

Afif Wahyudi Hidayat: Conceptualization, Methodology, Supervision, Writing – Original Draft.

Lyliana Endang Setianingsi: Validation, Formal Analysis, Writing – Review & Editing.

Emmelia Kristina Hutagaol: Investigation, Data Curation, Project Administration.

Conflicts of Interest

There is no conflict of interest.

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Supplementary Materials

Supplementary File S1: Research Instrument contains the full questionnaire used for data collection.

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