Indonesian Journal of Pharmaceutical Education (e-Journal) 2026; 6 (1): 38–46
ISSN: 2775- 3670 (electronic)
Journal Homepage: http://ejurnal.ung.ac.id/index.php/ijpe/index
DOI: 10.37311/ijpe.v6i1.36604

Association Between Medication Adherence and Tuberculosis Treatment Success: Cross-Sectional Primary Care Study in Indonesia

Ami Amelia[1*], Fitria Azzahra[2], Wili Octavia[3]
[1] *Medical Education Study Programme, Faculty of Medicine, Abdurrab University, Pekanbaru City, Indonesia.*
[2,3] *Professional Education Programme, Faculty of Medicine, Abdurrab University, Pekanbaru City, Indonesia.*
[*]*E-mail:ami.amelia@univrab.co.id*

Article Info:
Received: 5 December 2025
in revised form: 15 January 2026
Accepted: 27 January 2026
Available Online: 1 February 2026

Keywords:
Tuberculosis;
Medication adherence;
Treatment success;
DOTS;
Primary health care;
Indonesia

Corresponding Author:
Ami Amelia
Department of Medical Education
Faculty of Medicine
Abdurrab University
Riau City
Indonesia
E-mail:
ami.amelia@univrab.ac.id

ABSTRACT

Tuberculosis (TB) treatment success in primary care is closely linked to sustained medication adherence. This cross-sectional study assessed the association between adherence to anti-tuberculosis drugs and TB treatment success at Karya Wanita Primary Health Center, Pekanbaru, Indonesia, using routine TB programme records (2024–2025). Eligible records with complete adherence and outcome documentation were included (n = 75). Treatment success was defined as cured or treatment completed, whereas unsuccessful outcomes included failure, discontinuation, or death. Overall, 63 patients (84.0%) were adherent and 62 (82.7%) achieved treatment success. Treatment success was substantially higher among adherent than non-adherent patients (96.8% vs 8.3%), with a significant association by Fisher's exact test ($p < 0.001$). Adherence was associated with a markedly higher probability of treatment success (RR = 11.62; 95% CI: 1.78–75.92). Strengthening DOTS-aligned adherence support through treatment supporters (PMO), early counselling, reminders, and active tracing may improve outcomes.

How to cite (APA6thStyle):
Amelia,A.,Azzahra,F.,Octavia,A.(2026). *Association Between Medication Adherence and Tuberculosis Treatment Success: Cross-Sectional Primary Care Study in Indonesia. Indonesian Journal of Pharmaceutical Education (e-Journal), 6*(1), 38-46.

ABSTRAK

Keberhasilan pengobatan tuberkulosis (TB) di layanan kesehatan primer sangat dipengaruhi oleh kepatuhan pasien dalam mengonsumsi obat anti-TB secara berkelanjutan. Penelitian potong lintang ini menilai hubungan antara kepatuhan minum obat anti-TB dan keberhasilan pengobatan TB di Puskesmas Karya Wanita, Pekanbaru, Indonesia, menggunakan data rutin program TB (2024–2025). Rekam medis yang memenuhi kriteria dengan dokumentasi kepatuhan dan luaran pengobatan yang lengkap diikutkan (n = 75). Keberhasilan pengobatan didefinisikan sebagai sembuh atau pengobatan lengkap, sedangkan luaran tidak berhasil mencakup gagal, putus berobat, atau meninggal. Dari 75 pasien, 63 (84,0%) patuh dan 62 (82,7%) mencapai keberhasilan pengobatan. Keberhasilan pengobatan jauh lebih tinggi pada kelompok patuh dibanding tidak patuh (96,8% vs 8,3%), dengan hubungan bermakna berdasarkan uji Fisher ($p < 0,001$). Kepatuhan berasosiasi dengan peluang keberhasilan pengobatan yang jauh lebih tinggi (RR = 11,62; IK 95%: 1,78–75,92). Penguatan dukungan kepatuhan berbasis DOTS melalui PMO, konseling dini, pengingat, dan penelusuran aktif pasien yang absen berpotensi meningkatkan luaran pengobatan.

Kata Kunci: Tuberkulosis; Kepatuhan minum obat; Keberhasilan pengobatan; DOTS; Layanan kesehatan primer; Indonesia

1. Introduction

Tuberculosis (TB) remains a major infectious disease challenge globally and continues to exert a disproportionate burden in many low- and middle-income countries, including Indonesia, despite the availability of effective chemotherapy and standardised programme approaches. The most recent global synthesis underscores that the persistence of incident TB and preventable mortality is strongly intertwined with gaps in service coverage, diagnostic delays, and interruptions along the care cascade that compromise treatment completion and population-level transmission control [1]. In parallel, the End TB Strategy emphasises that achieving sustained reductions in TB incidence and deaths requires not only biomedical interventions, but also consistent implementation quality within routine health systems, particularly at the primary care level where most patients are initiated and monitored on therapy [2]. From a clinical and epidemiological standpoint, TB outcomes are shaped by a complex interplay of pathogen factors, host vulnerability, and health system performance; however, treatment continuity remains a pivotal programmatic hinge because incomplete therapy undermines bacteriological clearance and amplifies the risk of poor outcomes and ongoing transmission [3].

Within national TB control programmes, treatment success is operationally defined as cure or treatment completion, whereas unsuccessful outcomes include failure, treatment discontinuation (loss to follow-up), or death; thus, adherence to anti-tuberculosis drugs constitutes a central behavioural–service interface that can either consolidate or erode the effectiveness of standard regimens [4]. International guidance on TB prevention and treatment further highlights that the benefits of therapy are contingent upon sustained and correctly administered medication use across the recommended duration, reinforcing the rationale for structured adherence support and monitoring within routine services [5]. Consequently, the question of adherence is not merely a patient-level attribute, but an integrative indicator of regimen tolerability, patient counselling quality, social support, and the operational reliability of follow-up systems.

Evidence from global studies consistently indicates that non-adherence is associated with unfavourable TB outcomes and that the determinants of adherence are multidimensional, spanning patient beliefs and knowledge, medication adverse effects, stigma, socioeconomic constraints, and health-system barriers such as access and continuity of care [6]. Qualitative syntheses further demonstrate that prolonged treatment duration, symptom improvement that reduces perceived necessity of medication, fear of side effects, competing work–family priorities, and limited supportive communication with providers can precipitate missed doses and disengagement from services [7]. In response, directly observed treatment and other DOTS-aligned strategies have been widely promoted to strengthen treatment supervision and accountability, particularly through treatment supporters, structured counselling, and active follow-up of missed visits [8]. Nevertheless, systematic reviews continue to document that treatment non-adherence and loss to follow-up remain persistent programmatic challenges, indicating that adherence support must be context-sensitive and operationally feasible within real-world primary care workflows [9]. Conceptual work on medication adherence also reinforces that adherence is best understood as a dynamic behaviour shaped by interacting domains capability, opportunity, motivation, and system-level enabling factors rather than a single static patient trait [10].

In Indonesia, TB control is implemented through standardised national guidelines that mandate systematic diagnosis, treatment initiation, monitoring, and adherence support within primary health services, including the use of treatment supporters (PMO) and routine recording systems to track therapy progress and outcomes [4]. Despite this structured framework, local service realities may still produce variation in adherence and treatment success due to heterogeneity in patient characteristics, the consistency of counselling and follow-up, and the strength of family/community support systems. However, facility-based evidence that quantifies the association between adherence and treatment success in routine primary care settings remains limited, particularly in contexts where programme data are the primary source of monitoring and evaluation. Therefore, this study aimed to examine the association between medication adherence to anti-tuberculosis drugs and TB treatment success among patients treated at Karya Wanita Primary Health Center, Pekanbaru, Indonesia.

2. Methods

Study design and setting

This study used a quantitative, facility-based cross-sectional design to examine the association between medication adherence and tuberculosis (TB) treatment success in a routine primary care context [11], [12]. The study was conducted at Karya Wanita Primary Health Center, Pekanbaru City, Riau Province, Indonesia.

Data sources and study period

Secondary data were obtained from routine TB programme documentation, including the TB-01 register/forms and treatment supporter (PMO) supervision records. The treatment period covered January 2024 to October 2025, while data extraction, verification, and processing were conducted from 20 to 31 October 2025.

Population, eligibility criteria, and sampling

The study population comprised all TB patients registered at the health center during the study period (N = 137). A total sampling approach was applied to all eligible records [13]. Records were included in the analysis if they contained complete

documentation for: (i) adherence status from TB-01/PMO notes and (ii) final TB treatment outcome. Records were excluded if key variables were missing, if the treatment outcome was not yet recorded at the time of data extraction (ongoing treatment), or if documentation was insufficient for classifying adherence and outcome. Based on these criteria, 75 records were eligible for final analysis.

Variables and operational definitions

The independent variable was medication adherence to anti-tuberculosis drugs (locally referred to as OAT), classified as adherent or non-adherent according to routine programme documentation in TB-01 and PMO supervision notes (no additional adherence scale was applied). The dependent variable was TB treatment outcome, categorised as treatment success (cured or treatment completed) and unsuccessful outcome (treatment failure, treatment discontinuation/loss to follow-up, or death), consistent with national TB programme operational definitions [4].

Data collection and quality control

Data were extracted using a structured data extraction sheet. Quality control procedures included editing (completeness checking), coding (standardising variable categories), data entry, and data cleaning (detecting inconsistencies and duplication) prior to statistical analysis. To minimise information bias, adherence and outcome classifications were cross-checked between TB-01 entries and PMO notes when available.

Statistical analysis

Univariate analysis was performed using frequencies and percentages to describe respondent characteristics, adherence distribution, and treatment outcomes. Bivariate analysis assessed the association between adherence and treatment success using Fisher's exact test because the 2×2 contingency table contained small cell counts. Statistical significance was set at $p < 0.05$ (two-sided). Effect size was reported as risk ratio (RR) with 95% confidence interval (CI) to express the comparative probability of treatment success between adherent and non-adherent groups [12].

Ethical considerations

This study obtained ethical approval from the Health Research Ethics Committee, Faculty of Medicine, Universitas Abdurrab, with ethical clearance number 635/FK-UNIVRAB/B/X/2025. The study used secondary routine records; patient identifiers were removed during extraction, and analyses were conducted in an anonymised dataset.

3. Results and Discussion

Participant profile and descriptive findings

In routine tuberculosis (TB) services, baseline patient characteristics provide essential descriptive context for interpreting programme performance and subsequent association analyses. **Table 1** presents the profile of the analysed records (**n = 75**). Male patients constituted 44 (58.7%) of the sample, while females accounted for 31 (41.3%). Most patients were in the 17–64 years age group (60; 80.0%), with 15 (20.0%) aged ≥65 years. Regarding the primary exposure variable, 63 (84.0%) patients were classified as adherent, whereas 12 (16.0%) were non-adherent based on TB-01 and PMO documentation. For treatment outcome distribution, 62 (82.7%) achieved treatment success and 13 (17.3%) had unsuccessful outcomes. Overall, the predominance of adult and male patients is broadly aligned with commonly reported demographic patterns in TB notifications and clinical epidemiology, while sex-related differences in risk profiles and treatment outcomes have also been documented in multi-country analyses,

underscoring the importance of considering demographic context when interpreting programme indicators [3],[15]–[17].

Table 1. Participant characteristics, adherence status, and treatment outcomes (n = 75)

Characteristics	Category	n	%
Gender	Male	44	58.7
	Female	31	41.3
Age (years)	17–64	60	80.0
	≥65	15	20.0
Medication adherence	Adherent	63	84.0
	Non-adherent	12	16.0
Treatment outcome	Treatment success	62	82.7
	Unsuccessful outcome	13	17.3

Medication adherence and treatment success distribution

Medication adherence and treatment outcomes were described to provide a programme-level snapshot of treatment continuity and performance in routine TB care. Based on TB-01 and PMO documentation, 63 patients (84.0%) were adherent and 12 (16.0%) were non-adherent (Table 1). In parallel, treatment success was recorded in 62 patients (82.7%), whereas 13 (17.3%) experienced unsuccessful outcomes (**Table 1**). When interpreted against national programme expectations for treatment success (commonly operationalised as ≥85% in routine monitoring), the observed success proportion in this dataset was slightly below the benchmark [4]. From a health-system perspective, programme targets and performance indicators are also situated within broader global strategic directions that emphasise measurable improvements in treatment outcomes and patient-centred TB services [2]. Moreover, WHO guidance across the TB continuum highlights that the public health benefits of TB care (including prevention and treatment) depend on sustained engagement and completion of recommended interventions, supporting the importance of monitoring adherence-related processes in routine implementation [1], [5].

Association between adherence and treatment success

The cross-tabulation analysis demonstrated a pronounced difference in outcomes between adherent and non-adherent patients (**Table 2**). Treatment success among adherent patients reached 61/63 (96.8%), whereas among non-adherent patients it was only 1/12 (8.3%). Conversely, unsuccessful outcomes were rare in the adherent group (2/63; 3.2%) but predominated in the non-adherent group (11/12; 91.7%). Fisher's exact test confirmed a statistically significant association between medication adherence and treatment success ($p < 0.001$). In terms of effect magnitude, adherence was associated with a markedly higher probability of treatment success (RR = 11.62; 95% CI: 1.78–75.92). For completeness, the corresponding odds ratio was extremely large (OR = 335.5), reflecting sparse cells in the non-adherent success category; therefore, RR is emphasised as the more interpretable estimate for programme communication and clinical reasoning. This pattern is consistent with global evidence that sustained adherence is strongly linked to favourable TB outcomes, and that DOTS-aligned support (including treatment supporters/PMO, structured counselling, and active follow-up) remains central to reducing treatment interruption and loss to follow-up [6]–[10]. The direction of association is also consistent with evidence reported in Indonesian contexts that adherence to OAT is associated with recovery-related outcomes, supporting the

plausibility of adherence as a key programmatic lever within primary care TB services [18].

Table 2. Association between medication adherence and tuberculosis treatment success

Medication adherence	Treatment success, n (%)	Unsuccessful outcome, n (%)	Total, n (%)
Adherent	61 (96.8)	2 (3.2)	63 (100)
Non-adherent	1 (8.3)	11 (91.7)	12 (100)
Total	62 (82.7)	13 (17.3)	75 (100)

Note:
Statistical test: Fisher's exact test, $p < 0.001$.
Effect size: RR (treatment success) = 11.62; 95% CI: 1.78–75.92.
Additional measure (optional): OR = 335.5 (reported as odds ratio; not interpreted as PR/RR).

Interpretation in the context of DOTS and adherence determinants

The strong association between adherence and treatment success is clinically and programmatically plausible within the DOTS paradigm, while remaining interpretively constrained by the cross-sectional design and the use of routine records (i.e., the findings indicate association rather than causation). In TB care, sustained adherence is the immediate behavioural conduit through which standardised regimens can achieve bacteriological clearance and prevent programme-defined unsuccessful outcomes, making the observed gap between adherent and non-adherent groups consistent with the operational logic of DOTS [8], [9].

From an adherence science perspective, medication-taking behaviour reflects interacting determinants rather than a single "patient attribute". Conceptual syntheses indicate that adherence is shaped by multiple domains—capability, opportunity, motivation, therapy-related factors, and health-system enabling conditions—whose alignment determines whether patients can maintain consistent behaviour throughout prolonged TB regimens [10]. Qualitative evidence further shows that treatment fatigue over long durations, symptom improvement that reduces perceived urgency, fear or experience of adverse drug effects, and limited supportive communication can progressively erode adherence, particularly when follow-up is inconsistent or when patients face competing work–family demands [7]. Systematic reviews similarly identify non-adherence and loss to follow-up as persistent challenges, frequently linked to adverse events, weak social support, and discontinuities in service engagement, reinforcing why PMO supervision, early counselling, and active tracing are operationally critical in primary care settings [9].

Beyond biomedical and service-level considerations, broader social determinants such as poverty-related constraints, transport costs, precarious employment, and stigma can reduce the feasibility of continuous care engagement, thereby indirectly shaping adherence and downstream outcomes within routine TB services [14]. Importantly, treatment interruption is not only associated with immediate programme outcomes but may also contribute to longer-term risks, including recurrence/relapse or reinfection and post-TB sequelae, as suggested by systematic reviews of TB recurrence and post-TB complications [19], [20]. This broader consequence horizon strengthens the rationale for adherence-support interventions as a core component of TB control, consistent with contemporary understandings of TB epidemiology and pathogenesis [3], [15], [16].

Programme implications for primary care practice

The findings have direct operational relevance for strengthening routine TB care at the primary health centre level. Given the substantial gap in treatment success between adherent and non-adherent patients, adherence support should be positioned as a core, measurable component of service quality rather than an ancillary activity. Practically, this can be pursued through more consistent engagement of treatment supporters (PMO) and structured follow-up aligned with DOTS principles, particularly for patients who begin to miss doses or appointments [8]. Early, proactive counselling on anticipated adverse drug effects including how to manage common symptoms and when to seek care may reduce avoidable discontinuation and reinforce patients' confidence in completing therapy. In addition, low-cost reminder systems (e.g., SMS/WhatsApp) and systematic active tracing of missed visits can strengthen continuity of care and reduce loss to follow-up, especially in settings where competing obligations and access barriers commonly disrupt scheduled follow-up. These actions are consistent with national operational guidance for TB service delivery and monitoring in primary care [4] and align with the End TB strategic direction emphasising patient-centred care, strengthened health systems, and intensified programmatic accountability to improve routine treatment outcomes [2]. WHO guidance on TB prevention and care continuity further supports integrated, sustained engagement approaches across the TB care continuum, reinforcing the relevance of adherence-support systems in routine implementation [5].

Limitations of study

This study has limitations that should be considered when interpreting the results. First, the analysis relied on routinely recorded secondary data; therefore, misclassification of adherence status or treatment outcomes may occur due to incomplete or inconsistent documentation. Second, the study examined a limited set of variables, and potential confounders such as comorbidities, socioeconomic status, adverse drug reactions, and access-related barriers were not available for adjustment, which may influence both adherence and outcomes. Third, the small number of non-adherent patients yielded wide confidence intervals around the effect estimate, indicating uncertainty in the magnitude of association despite the clear direction of the relationship. Finally, because the design was cross-sectional and facility-based, the findings should be interpreted as associative and may not be generalisable beyond similar primary care contexts.

4. Conclusion

In this facility-based cross-sectional study using routine TB programme records at Karya Wanita Primary Health Center, medication adherence was strongly associated with tuberculosis treatment success. Treatment success was substantially higher among adherent than non-adherent patients (96.8% vs 8.3%), and the association was statistically significant by Fisher's exact test ($p < 0.001$). Adherent patients had a markedly higher probability of achieving treatment success (RR = 11.62; 95% CI: 1.78–75.92). These findings underscore the practical importance of strengthening DOTS-aligned adherence support in primary care, particularly through consistent PMO engagement, early counselling on adverse effects, reminder systems, family involvement, and active tracing of missed visits to minimise treatment interruption and improve routine TB outcomes.

Acknowledgements:
The author would like to express gratitude to the Faculty of Medicine, Abdurrab University, Pekanbaru City, and the Karya Wanita Primary Health Center, Pekanbaru, for providing the necessary support and facilities throughout the research process.

Conflicts of Interest:
The author declares that there are no conflicts of interest in this research.

References

[1] World Health Organization, *Global Tuberculosis Report 2024*. Geneva, Switzerland: WHO, 2024, ISBN: 978-92-4-010153-1. [Online]. Available: https://cdn.who.int/media/docs/default-source/hq-tuberculosis/global-tuberculosis-report-2024.pdf

[2] M. Uplekar, D. Weil, K. Lönnroth, E. Jaramillo, C. Lienhardt, and M. Raviglione, "WHO's new End TB strategy," *The Lancet*, vol. 385, no. 9979, pp. 1799–1801, 2015. [Online]. Available: https://doi.org/10.1016/S0140-6736(15)60570-0

[3] S. D. Lawn and A. Zumla, "Tuberculosis," *The Lancet*, vol. 378, no. 9785, pp. 57–72, 2011. [Online]. Available: https://doi.org/10.1016/S0140-6736(10)62173-3

[4] Ministry of Health of the Republic of Indonesia, *National Guidelines for Medical Service Management of Tuberculosis*. Jakarta, Indonesia: MoH RI, 2020. [Online]. Available: https://repository.p2p.kemkes.go.id/884/

[5] World Health Organization, *WHO Consolidated Guidelines on Tuberculosis: Module 1 – Prevention: Tuberculosis Preventive Treatment*, 2nd ed. Geneva, Switzerland: WHO, 2024, ISBN: 978-92-4-009619-6. [Online]. Available: https://www.who.int/publications/i/item/9789240096196

[6] G. J. Fox, A. J. White, S. V. Macdonald, and M. B. Denholm, "Adherence to tuberculosis treatment: Lessons from global studies," *The International Journal of Tuberculosis and Lung Disease*, vol. 21, no. 7, pp. 722–732, 2017. [Online]. Available: https://theunion.org/our-work/journals/ijtld

[7] S. A. Munro, S. A. Lewin, H. J. Smith, M. E. Engel, A. Fretheim, and J. Volmink, "Patient adherence to tuberculosis treatment: A systematic review of qualitative research," *PLoS Medicine*, vol. 4, no. 7, p. e238, 2007. [Online]. Available: https://doi.org/10.1371/journal.pmed.0040238

[8] T. R. Frieden and J. A. Sbarbaro, "Promoting adherence to treatment for tuberculosis: The importance of directly observed therapy," *Bulletin of the World Health Organization*, vol. 85, no. 5, pp. 407–409, 2007. [Online]. Available: https://doi.org/10.2471/BLT.06.038927

[9] H. H. Tola, *and co-authors*, "Tuberculosis treatment non-adherence and lost to follow-up: A systematic review," *Infectious Diseases of Poverty*, vol. 4, p. 37, 2015. [Online]. Available: https://doi.org/10.1186/s40249-015-0067-7

[10] K. Q. E. Peh, R. Kwan, Y. M. Seah, M. S. Fong, C. C. J. Koh, J. F. W. Chan, and E. Thumboo, "An adaptable framework for factors contributing to medication adherence: Results from a systematic review of 102 conceptual frameworks," *Journal of General Internal Medicine*, vol. 36, no. 9, pp. 2784–2795, 2021. [Online]. Available: https://doi.org/10.1007/s11606-021-06648-1

[11] T. Y. Akalu, *and co-authors*, "Risk factors associated with post-tuberculosis sequelae: A systematic review and meta-analysis," *eClinicalMedicine*, vol. 77, p. 102898, 2024. [Online]. Available: https://doi.org/10.1016/j.eclinm.2024.102898

[12] V. Vega, *and co-authors*, "Risk factors for pulmonary tuberculosis recurrence, relapse and reinfection: A systematic review and meta-analysis," *BMJ Open*

Respiratory Research, vol. 11, no. 1, p. e002281, 2024. [Online]. Available: https://doi.org/10.1136/bmjresp-2023-002281

[13] O. Skouvig Pedersen, *and co-authors*, "Sex differences in risk factors for unsuccessful tuberculosis treatment outcomes in Eastern Europe from 2020 to 2022: A multi-country retrospective cohort study," *The Lancet Regional Health – Europe*, vol. 55, p. 101354, 2025. [Online]. Available: https://doi.org/10.1016/j.lanepe.2025.101354

[14] K. Lönnroth, C. Jaramillo, B. G. Williams, C. Dye, and M. Raviglione, "Drivers of tuberculosis epidemics: The role of risk factors and social determinants," *Social Science & Medicine*, vol. 68, no. 12, pp. 2240–2246, 2009. [Online]. Available: https://doi.org/10.1016/j.socscimed.2009.03.041

[15] K. Dheda, C. E. Barry, and G. Maartens, "The epidemiology, pathogenesis, and diagnosis of tuberculosis," *Respirology*, vol. 21, no. 1, pp. 23–34, 2016. [Online]. Available: https://doi.org/10.1111/resp.12675

[16] M. C. Raviglione, "Tuberculosis," in *Harrison's Principles of Internal Medicine*, 20th ed., J. L. Jameson, A. S. Fauci, D. L. Kasper, S. L. Hauser, D. L. Longo, and J. Loscalzo, Eds. New York, NY, USA: McGraw-Hill Education, 2018, ISBN: 9781259644016. [Online]. Available: https://accessmedicine.mhmedical.com/book.aspx?bookID=2129

[17] D. D. Pratiwi and I. Syafina, "Adherence to anti-tuberculosis drugs is associated with cure among pulmonary tuberculosis patients at Rokan Hulu Regional General Hospital," *Jurnal Pandu Husada*, vol. 6, no. 3, 2025. [Online]. Available: https://doi.org/10.30596/jph.v6i3.22027

[18] Sugiyono, *Quantitative, Qualitative, and R&D Research Methods*. Bandung, Indonesia: Alfabeta, 2019. [Online]. Available: https://openlibrary.telkomuniversity.ac.id/home/catalog/id/176448/slug/metode-penelitian-kuantitatif-kualitatif-dan-r-d.html

[19] S. Sastroasmoro and S. Ismael, *Fundamentals of Clinical Research Methodology*, 4th ed. Jakarta, Indonesia: Sagung Seto, 2011. [Online]. Available: https://library.unpas.ac.id/opac/detail-opac?id=84231

[20] J. W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 4th ed. Thousand Oaks, CA, USA: SAGE Publications, 2014. [Online]. Available: https://books.google.com/books?id=4uB76IC_pOQC