



How Does Indonesian Chronic Disease Patient Adhere to Their Treatment? A Cross-Sectional Analysis of 11,408 Subjects

Ivan Surya Pradipta ^{1,2,*}, Kevin Aprilio ^{1,2,*}, Yozi Fiedya Ningsih ^{1,2},
Mochammad Andhika Aji Pratama², Vesara Ardhe Gatera³, Sofa Dewi Alfian ^{1,2},
Aulia Iskandarsyah ⁴, Rizky Abdulah^{1,2}

¹Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Padjadjaran, Sumedang, West Java, 45363, Indonesia; ²Drug Utilization and Pharmacoepidemiology Research Group, Center of Excellence in Higher Education for Pharmaceutical Care Innovation, Universitas Padjadjaran, Sumedang, West Java, 45363, Indonesia; ³Department of Pharmaceutical Biology, Faculty of Pharmacy, Universitas Padjadjaran, Sumedang, West Java, 45363, Indonesia; ⁴Department of Clinical Psychology, Faculty of Psychology, Universitas Padjadjaran, Sumedang, West Java, 45363, Indonesia

*These authors contributed equally to this work

Correspondence: Ivan Surya Pradipta, Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Padjadjaran, Jalan Ir. Soekarno KM 21, Jatinangor, Sumedang, West Java, 45363, Indonesia, Email ivanpradipta@unpad.ac.id

Background: Chronic disease has become an increasing burden in Indonesia, increasing the importance of treatment adherence to control the disease prognosis. Therefore, we aim to determine the prevalence and characteristics of nonadherence in Indonesian chronic disease population.

Methods: We identified 11,408 adult subjects with chronic diseases from the fifth Indonesian Family Life Survey. We defined treatment nonadherence as the outcome variable and characteristics related to the World Health Organization Multidimensional Adherence Model as exposure variables. We used descriptive and multivariable analyses to analyze factors related to treatment nonadherence.

Results: We identified that 57% (95% CI 56.1–57.9) of chronic disease patients were nonadherent to their treatment. Treatment nonadherence was notable in subjects with liver disease (61.8%), tuberculosis (59.8%), digestive diseases (57.9%), other lung diseases (56.8%), psychiatric diseases (51.6%), asthma (51.2%), and hypertension (50%). Treatment nonadherence was associated with socioeconomic-related factors of being aged 15–65 years, living in rural areas, having history of formal education, and having a household size of 2–6 people. Furthermore, in patient- and condition-related factors, positive perceptions of their health condition, missing 0–7 days of their regular activity in the last month, being ex- and non-smokers, having no depression symptoms, and having only one chronic disease were associated with treatment nonadherence.

Conclusion: Treatment nonadherence for chronic diseases in Indonesia was found to be prevalent. Further consideration of characteristics associated with treatment nonadherence should be given to ensure optimal control of chronic diseases.

Keywords: chronic diseases, adherence, socioeconomic factors, patient-related factors, condition-related factors

Introduction

Chronic diseases have become a leading issue in healthcare in terms of morbidity and mortality globally.¹ They can cause disturbances in physical and social functioning, quality of life, and the economic sustainability of the healthcare system.^{2,3} The impact is most notable in lower-middle-income countries (LMICs).¹ Out of the 41 million deaths due to non-communicable diseases in 2019, 77% occurred in LMICs.¹ These data are predicted to increase to 52 million by 2030, with 42 million occurring in LMICs.⁴

Indonesia is an LMIC that has a high burden of chronic diseases.⁵ Data demonstrated that chronic diseases caused 69.9% of lost disability-adjusted life years.⁶ Chronic diseases constitute the most significant proportion of the causes of death in Indonesia at 76%.⁷ The increased prevalence of chronic diseases in adolescents has further disrupted the quality of life and individual productivity and could affect economic aspects in the future.⁸ Other than that, chronic diseases compose the largest cost absorber in the national health insurance system, contributing to around 60% of its spending.^{8,9} The data highlighted that chronic diseases increase the healthcare burden and utilization of health services and medication in Indonesia.⁹

Treatment adherence is paramount in managing chronic diseases.¹⁰ It is defined as a process in which patients follow agreed-upon recommendations for prescribed treatment from a healthcare provider.¹⁰ As part of treatment adherence, regular medication is required for patients with chronic diseases that involve several phases, ie, the initiation, implementation, and continuation phases.^{11,12} In previous studies, treatment nonadherence was high among several types of chronic disease patients in Indonesia. A low level of treatment adherence was identified among 93.6% of hypertension patients, while 71% of diabetes mellitus (DM) patients did not receive regular treatments.^{13,14} In breast cancer patients, 21 of 50 cancer patients postponed the treatment after receiving the diagnosis, which led to treatment nonadherence.¹⁵ Several factors could explain this phenomenon, such as socioeconomic, health system/care team, therapy, condition, and patient-related factors.¹⁰

Problems related to treatment nonadherence among chronic diseases were identified in previous studies. Long duration and accessibility to health facilities are reported in chronic disease patients.^{16–18} Another study showed that being elderly, having depressive symptoms, and having low satisfaction with healthcare services were associated with low adherence to hypertension treatment.¹⁹ In diabetes mellitus (DM) patients, a study demonstrated that not having insurance coverage and older ages were associated with low awareness of DM treatment.²⁰ Problems described in the previous studies highlighted that treatment nonadherence can worsen diseases, leading to disability, increased healthcare costs, and mortality.^{21,22}

Therefore, current Indonesia's national health insurance program—provided by *Badan Penyelenggara Jaminan Sosial Kesehatan*, or BPJS Kesehatan—has devised PROLANIS (*Program Penanggulangan Penyakit Kronis*) to mitigate the growing number of chronic disease patients in Indonesia.²³ Despite the growing participant number of BPJS Kesehatan of up to 90.24% in 2022,²⁴ studies of PROLANIS implementation indicated the program's inadequacy in managing chronic diseases.^{25–27} This issue is worsened by the low coverage of private health insurance in Indonesia of only 33.4%,²⁸ which all affects patients' access to treatment.²⁹

Analysis of dimensions to treatment adherence remains low in Indonesia, despite being known to affect treatment outcome of chronic disease patients.¹⁰ Identifying the prevalence and factors associated with treatment nonadherence in various chronic diseases can provide a comprehensive picture of the treatment nonadherence situation for developing strategies to control chronic diseases in Indonesia.¹⁰ We, therefore, seek to identify the prevalence of treatment nonadherence and analyze its characteristics in chronic disease patients in Indonesia.

Methods

Study Design and Setting

We conducted a cross-sectional study using the nationwide database of the fifth Indonesian Family Life Survey (IFLS-5; <https://www.rand.org/well-being/social-and-behavioral-policy/data/FLS/IFLS.html>). IFLS itself is a longitudinal project that, to date, has been conducted five times since its inception in 1993. IFLS-5, as its fifth wave, was fielded in late 2014 and early 2015.³⁰ The national survey collected individual, household, and community data using multistage stratified sampling.³⁰

The IFLS-5 data were collected from households living in 13 out of 27 Indonesian provinces, which represented approximately 80% of the Indonesian population.³¹ IFLS-5 employed stratified sampling on each of the provinces and its juridical subdivisions. This sampling strategy was employed to optimize population representation in terms of the cultural and socioeconomic diversity and cost-effectiveness of the survey, given Indonesian demographical and geographical characteristics.³¹

Random households were sampled from the resulting 321 enumeration areas (EAs) spread across the 13 provinces, with an oversampling for urban EAs and EAs in the smaller provinces to facilitate geographic and demographic comparisons. 20 and 30 households from urban and rural EAs respectively were sampled.³¹ The IFLS-5 collected sociodemographic, economic, and health status characteristics through a previously validated questionnaire to confirm its reliability and validity.³¹

Institutional Review Boards of the RAND Corporation in the United States and Universitas Gadjah Mada in Indonesia provided the ethical approval for the IFLS-5.³¹ Written informed consent was obtained from all subjects prior to the survey process.³¹ Therefore, additional ethical approval is not mandatory for this current study, noting the previous ethical approval of the IFLS-5 study and the anonymized nature of the data. We followed the guidelines outlined by Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) to provide a transparent and systematic report.³²

Participants and Study Size

The IFLS-5 recorded subject's self-report of diagnosis chronic diseases to the following classifications: hypertension, diabetes, tuberculosis, asthma, other lung diseases, cardiovascular diseases, liver diseases, stroke, cancers, arthritis, dyslipidemia, prostate diseases, kidney diseases, digestive diseases, psychiatric diseases, and memory-related diseases. These conditions were determined by the following question: "Has a doctor/paramedic/nurse/midwife ever told you that you had [types of chronic disease]?" (Book IIIB/CD05). Subjects who reported diagnosis to any of the diseases were classified as chronic disease patients.³¹

To obtain a representative association between subjects' characteristics and treatment adherence, we excluded subjects aged < 15 years measured with a different instrument in the IFLS-5 (Book V). Therefore, we included all subjects aged > 15 years who reported receiving formal diagnosis of chronic disease. Subjects with missing data were further excluded from our analysis.

Variables and Measurement

Exposure Variables

The potential variables were selected from the IFLS-5 questionnaire based on the Multidimensional Adherence Model by the World Health Organization (WHO) in relation to individual patient conditions.¹⁰ Three dimensions were included for analysis: socioeconomic-, disease-, and patient-related conditions. These variables are further described as operational definitions in [Table S1](#).³¹

Socioeconomic Factors

Socioeconomic factors are composed of information on sociodemographic characteristics, such as sex (male and female), age group (15 to 65 years and > 65 years), education (unschooled and schooled), ethnicity (Javanese and non-Javanese), geographical residence (Java and non-Java), demographical residence (urban and rural), household size (1, 2 to 6, and > 6 person), health insurance (insured and noninsured), and annual income (not working, < 12 to 14, 40 to 100, and > 100 million rupiah).

Patient-Related Factors

Patient-related factors were used to analyze the perception and expectation of subjects toward their health conditions, which were acquired to gain information about previous, present, and prospective health conditions. Data were yielded using three questions: (1) "In general, how is your health?" (2) "During the last 4 weeks, how many days of your primary daily activities did you miss due to poor health?" (3) "How do you expect your health to be in next year?"³¹ Responses for (1) were classified into *unhealthy* and *healthy*. For (2), responses were classified into *0 to 7 days* and *> 7 days*. Lastly, responses to (3) were classified into *worse* and *about the same/better*.

Disease-Related Factors

The condition-related factors included smoking behavior, depression symptoms, and the number of morbidities. Smoking behavior was categorized into ex-, non-, and active smokers. Depressive symptoms were assessed using the Centers for

Epidemiologic Studies Depression Scale,³³ where scores > 9 were classified as having depressive symptoms.³³ Multimorbidity was categorized based on the number of chronic diseases reported by the subject.

Outcome Variables

The study outcome was determined by identifying treatment nonadherence by analyzing the treatment behavior of subjects, which were classified based on the available data in IFLS-5 as adherent and nonadherent subjects. This criterion was identified by the following survey question: “Are you now taking the following treatments to treat [types of chronic diseases] and its complications?” (Book III/CD09).³¹ Owing to the dependence of formal diagnosis in determining the subject’s chronic disease status, we assumed prescription to be an inherent part of the clinical process and subsequently classified those who reported receiving no treatment for their chronic diseases as nonadherent subjects. Therefore, in accordance with the IFLS-5 database,³¹ this study defined nonadherence as interruptions to treatment regimen within the persistence phase.¹¹

Data Analysis

Descriptive analysis was used to summarize subjects’ characteristics, chronic disease proportions, and prevalence of treatment nonadherence. A chi-square test was performed to analyze the bivariate association between the exposure and outcome variables. A subsequent multivariable analysis included associated exposure variables with a *p*-value of < 0.25. The multivariable logistic regression with an entry method was used to identify factors associated with treatment adherence, with a *p*-value of < 0.05 as the threshold for association. The odds ratio (OR) with a 95% confidence interval (95% CI) was used to assess the magnitude of association between the exposure and outcome variables in the multivariable analysis. A Hosmer–Lemeshow test was used to validate the multivariable test result based on the goodness-of-fit statistics of the resulting R^2 value.³⁴ All statistical analyses were conducted using SPSS® Statistics version 22.³⁵

Results

Participant Characteristics

In summary, 11,419 subjects with chronic diseases were included for further analysis, but we excluded 11 due to missing information. The final number of subjects for further analysis was 11,408. [Figure 1](#) provides a flow diagram of the subjects.

Most of the included subjects were female (59.3%), aged 15 to 65 years (87.9%), and had a formal education background or were schooled (93.2%). Among the subjects, 35.1% were not working and 56.2% had an income of < 12 to 60 million rupiah per year. We found that 82.8% expected their health to be the same or better, 64.6% perceived they had a health condition, and 69.2% had one chronic disease. Missing data were identified in some variables with an acceptable percentage (< 10%).³⁶ Hence, no specific approach was taken to manage the missing data. [Table 1](#) depicts the characteristics of the subjects and the missing data.

As illustrated in [Figure 2](#), digestive diseases exhibited the highest prevalence (38.4%; 95% CI 37.5–39.3), followed by hypertension (36.9%; 95% CI 36–37.8), arthritis (15.2%; 95% CI 14.5–15.9), dyslipidemia (12.2%; 95% CI 11.6–12.8), asthma (8.8%; 95% CI 8.3–9.3), and diabetes (6.8%; 95% CI 6.3–7.3), whereas the lowest prevalence was noted for memory-related diseases (0.8%; 95% CI 0.6–0.9). Among these figures, 57% of all chronic disease patients were found to be nonadherent, with the highest proportion of nonadherence in liver diseases (61.8%) and the lowest in stroke (26.8%).

Factors to Treatment Nonadherence

During the bivariate analysis, various factors, including sex, age, education, residential site, household size, income, health insurance, health condition, smoking behavior, depressive symptoms, and the number of morbidities, were found to have a *p*-value of ≤ 0.25 . Consequently, these factors were incorporated into the multivariable model.

The results pointed to ten characteristics that are significantly associated with treatment nonadherence, such as age 15 to 65 years (OR 1.64; 95% CI 1.39–1.94; $p < 0.001$), schooled (OR 1.52; 95% CI 1.23–1.88; $p < 0.001$), living in rural

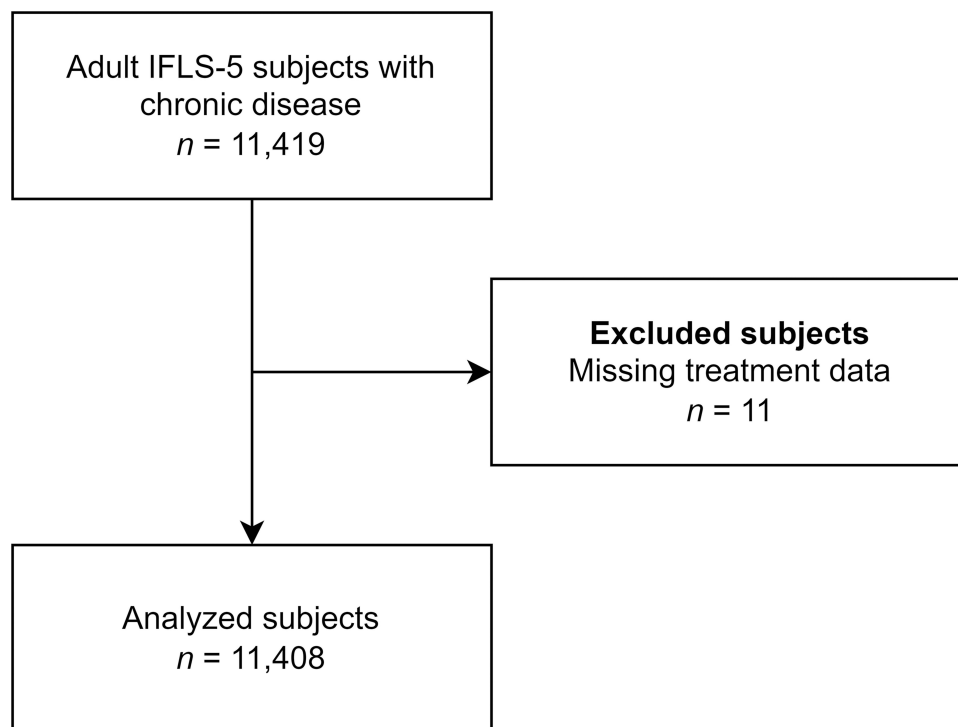


Figure 1 Flow Diagram of Subjects.

areas (OR 1.12; 95% CI 1.03–1.23; $p = 0.010$), household size of 2–6 people (OR 1.11; 95% CI 1.02–1.22; $p = 0.019$), healthy condition (OR 1.57; 95% CI 1.43–1.73; $p < 0.001$), missed 0 to 7 days of regular activities in the last month (OR 1.61; 95% CI 1.38–1.89; $p < 0.001$), expecting health to be the same or better (OR 1.29; 95% CI 1.11–1.50; $p = 0.001$),

Table 1 Characteristic of Respondents with Chronic Diseases ($n = 11,408$)

No	Characteristics	Frequency (%)
I	Socioeconomic factors	
	Female*	6,762 (59.3)
	Age (years)	
	15–65	10,030 (87.9)
	>65	1,378 (12.1)
	Formal education history*	10,633 (93.2)
	Non-Javanese ethnicity*	6,205 (54.4)
	Rural residence*	4,183 (36.7)
	Non-Java residence*	4,784 (41.9)
	Household size (people)	
	1	381 (3.3)
	2 to 6	7,143 (62.6)
	> 6	3,884 (34.1)
	Annual income (millions of Indonesian Rupiah)*	
	Not working	4,007 (35.1)
	< 40	6,409 (56.2)
	40 to 100	741 (6.5)
> 100	161 (1.4)	
No health insurance ownership*	5,196 (45.5)	

(Continued)

Table 1 (Continued).

No	Characteristics	Frequency (%)
2	Patient-related factors	
	Perceived current health condition	
	Unhealthy	4,039 (35.4)
	Healthy	7,369 (64.6)
	Days missed at primary activity last month*	
	0 to 7	10,192 (89.3)
	> 7	1,205 (10.6)
Health expectation next year*		
Worse	952 (8.3)	
About the same/better	9,442 (82.8)	
3	Condition-related factors	
	Smoking behavior	
	Ex-smokers	876 (7.7)
	Non-smokers	7,693 (67.4)
	Active smokers	2,839 (24.9)
	No depressive symptoms*	7608 (66.7)
No multimorbidity	7,895 (69.2)	

Notes: *=missing value: Sex 2 (0.0%), Education 91 (0.8%), Ethnicity 62 (0.5%), Demographical residence 2 (0.0%), Income 90 (0.8%), Insurance ownership 29 (0.3%), Days missed at primary activity last month 11 (0.1%), Health expectation in the next year: 1,014 (8.9%), Depressive symptoms 1,016 (8.9%).

nonsmoker (OR 1.41; 95% CI 1.16–1.70; $p < 0.001$), active smoker (OR 1.62; 95% CI 1.35–1.94; $p < 0.001$), without depressive symptoms (OR 1.11; 95% CI 1.01–1.22; $p = 0.038$), and without multimorbidity (OR 2.93; 95% CI 2.67–3.21; $p < 0.001$). **Table 2** presents the bivariate and multivariable analyses.

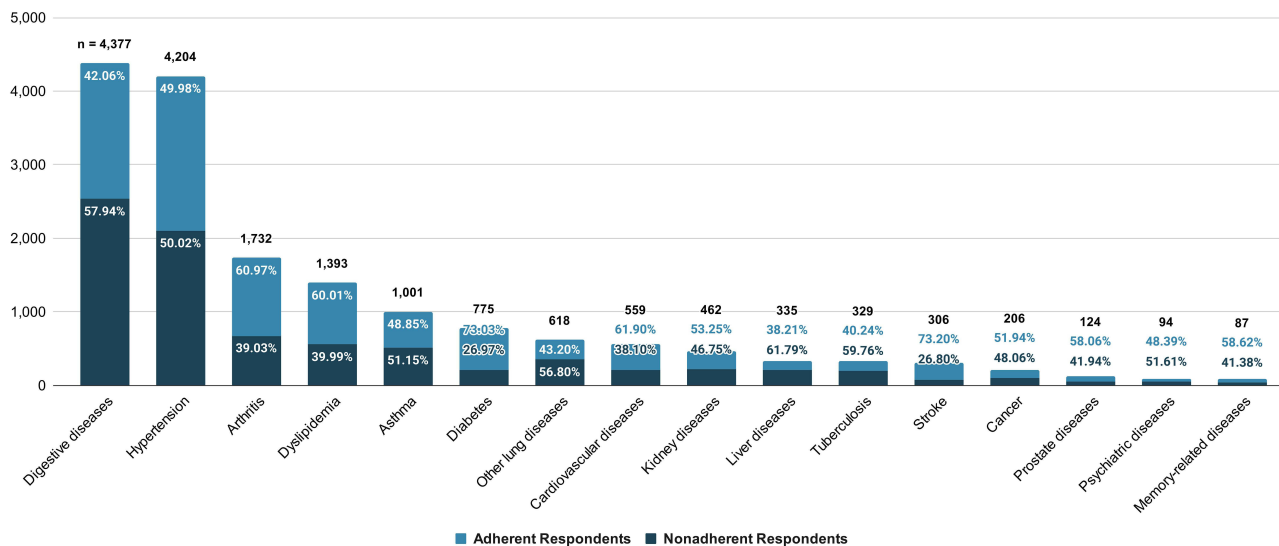


Figure 2 Proportion of Treatment Nonadherence across Chronic Diseases.

Table 2 Characteristics Associated with Nonadherence (n = 11,408)

No	Characteristics	Adherent (n = 4,901)	Nonadherent (n = 6,507)	Bivariable		Multivariable	
				OR (95% CI)	p-value	aOR (95% CI)	p-value
1	Socioeconomic factors						
	Female	3,004	3,758	0.86 (0.80–0.93)	< 0.001	0.94 (0.83–1.07)	0.360
	Age (years)						
	15 to 65	4,077	5,953	2.17 (1.94–2.44)	< 0.001	1.64 (1.39–1.94)	< 0.001
	> 65	824	554	Reference			
	Formal education history	4,475	6,158	1.83 (1.56–2.13)	< 0.001	1.52 (1.23–1.88)	< 0.001
	Non-Javanese ethnicity	2,694	3,511	1.04 (0.96–1.12)	0.327	Not included	
	Rural residence	1,736	2,447	1.10 (1.02–1.19)	0.017	1.12 (1.03–1.23)	0.010
	Non-Java residence	2,030	2,754	1.04 (0.96–1.12)	0.334	Not included	
	Household size (person)						
	1	147	234	1.44 (1.16–1.79)	0.001	1.08 (0.85–1.36)	0.063
	2 to 6	2,909	4,234	1.32 (1.22–1.43)	< 0.001	1.11 (1.02–1.22)	0.019
	> 6	1,845	2,039	Reference			
	Annual income (millions of Indonesian Rupiah)						
	> 100	67	94	1.24 (0.90–1.70)	0.195	1.04 (0.94–1.15)	0.417
	40 to –100	321	420	1.15 (0.98–1.35)	0.079	0.85 (0.59–1.21)	0.355
	< 12 to 40	2,599	3,810	1.29 (1.19–1.40)	< 0.001	1.04 (0.94–1.15)	0.417
Not Working	1,876	2,131	Reference				
Health insurance							
No	2,172	3,024	1.09 (1.01–1.17)	0.031	1.01 (0.93–1.11)	0.743	
2	Patient-related factors						
	Perceived current health condition						
	Healthy	2,669	4,700	2.18 (2.01–2.35)	< 0.001	1.57 (1.43–1.73)	< 0.001
	Unhealthy	2,232	1,807	Reference			
	Days missed at primary activity last month						
	0 to 7 Days	4,131	6,061	2.56 (2.26–2.90)	< 0.001	1.61 (1.38–1.89)	< 0.001
	> 7 Days	766	439	Reference			
Health expectation in next year							
About the same/better	3,829	5,613	1.71 (1.50–1.96)	< 0.001	1.29 (1.11–1.50)	0.001	
Worse	513	439	Reference				
3	Condition-related factors						
	Smoking behavior						
	Active smokers	1,077	1,762	2.13 (1.82–2.48)	< 0.001	1.62 (1.35–1.94)	< 0.001
	Non-smokers	3,329	4,364	1.70 (1.48–1.96)	< 0.001	1.41 (1.16–1.70)	< 0.001
	Ex-smokers	495	381	Reference			
	No depressive symptoms	3,082	4,526	1.21 (1.11–1.32)	< 0.001	1.11 (1.01–1.22)	0.038
No multimorbidity	2,665	5,230	3.44 (3.16–4.73)	< 0.001	2.93 (2.67–3.21)	< 0.001	

Note: The multivariable model was validated by Hosmer-Lemeshow with a p-value of 0.61 and an R² value of 0.144.

Abbreviations: OR, odds ratio; aOR, adjusted odds ratio.

Discussion

This study demonstrated that cardiovascular problems and hypertension had the highest prevalence rates among chronic diseases. We also identified that nonadherence to treatment was high and was observed in all chronic diseases. The highest proportion of nonadherence was noted in subjects with liver, tuberculosis, and digestive problems. The socioeconomic characteristics of nonadherent subjects were identified in the group aged 15 to 65 years, had a formal education background, lived in rural areas, and had a household size of 2 to 6 people. In the patient- and condition-related factors, subjects with a positive perception of their health condition who missed 0 to 7 days of regular activities in the last month, ex- and nonsmokers, without depression symptoms, and with only one chronic disease were identified as the associated characteristics for treatment nonadherence.

The study demonstrated that 57% of patients with chronic diseases were nonadherent to treatment. This result was relatively consistent with that of the WHO report, which estimated that the adherence rate to long-term therapy for chronic diseases in LMICs was around 50%.¹⁰ Compared with high-income countries, the cases of pharmacological nonadherence in Spain and Japan were lower than those in Indonesia (48.8% and 17.7%, respectively).^{37,38} Similarly, a high nonadherence rate was found in Ghana (55.5%).³⁹ This could be due to an inadequate healthcare system and inequality in access to healthcare in LMICs.^{4,10} Other than that, human resources, the availability of infrastructure and medical equipment, and medicines are still challenges in Indonesia.⁴⁰ Despite the wide range of nonadherence rates across the countries, the main concern is that nonadherence remains a significant problem in the treatment of chronic diseases.⁴¹

The current study demonstrated that subjects aged 15 to 65 years are more likely to be nonadherent to treatment compared with those aged > 65 years. This result may be attributed to the lower severity of chronic diseases among younger patients compared to older ones.⁴² This finding leads to the increased potential of treatment nonadherence at a younger age due to the lower severity of diseases.⁴² This notion was also supported by the study finding that the group with a positive perception of their health condition and fewer days missing regular activities was less adherent to treatment than its comparators (Table 2).

The association between education status and nonadherence is inconsistent across other studies. Although previous studies demonstrated that high levels of education exerted a positive relationship with adherence,^{43,44} the current study found that subjects with formal educational backgrounds are significantly associated with treatment nonadherence. Nevertheless, our finding was supported by a previous study that reported low adherence among patients with high levels of education.⁴⁵ However, another study found no significant association between adherence and health literature due to education levels.⁴⁶ These different findings highlight the need for further studies to explain the association between education status and nonadherence to treatment.

The current study further identified that living in rural areas was associated with treatment nonadherence, which can be explained by issues with access to qualified healthcare services. This finding was supported by previous studies that stated that long distances from healthcare facilities and affordable medication influence treatment nonadherence.^{47–49}

Regarding household size, previous studies demonstrated that having more family members and friends could provide social support for treatment adherence.^{41,50,51} In contrast, the current study found that having two to six family members was associated with treatment nonadherence compared with a household size of more than six. We inferred that the number of family members should not directly influence behavior toward adherence. Theoretically, the essential factors related to the household size that led to nonadherence were the lack of support from family members, irregular supervision, conflicts, low levels of education of parents, and family beliefs about the nature of illnesses.^{50,51}

Importantly, we identified that the self-assessment of health conditions was associated with treatment nonadherence, especially for subjects who perceived themselves as healthy. This study underlined the link between adherence and the feeling of poor health conditions, which is in line with a systematic review that proposed that several factors can influence treatment nonadherence, such as asymptomatic diseases, clinical improvement, symptom reduction, and feeling better, whereas disease severity positively influenced adherence.⁵⁰

Consistent with other studies, the current study found that subjects who smoked had the highest probability of treatment nonadherence. Previous studies identified that active smokers were more likely to be nonadherent to treatments for hypertension, asthma, and renal transplantation.^{41,50} However, in another group, we identified that nonsmokers are more likely to be nonadherent than ex-smokers. A possible explanation is that ex-smokers may have ceased smoking due

to their chronic condition; hence, this group displays higher levels of awareness about their health conditions and treatment than nonsmokers. This result implies that nonsmokers are more likely to be nonadherent than ex-smokers.

In contrast with other studies, we analyzed that subjects without depressive symptoms and with only one chronic disease were associated with treatment nonadherence. In previous studies, depression and multimorbidity status were reported as factors that influence nonadherence to treatment.^{41,50,52} These conflicting results may be due to these groups' health awareness levels. The positive effect of multimorbidity on adherence may be associated with the perception of the disease, such as a person with multimorbidities may perceive more severe conditions compared with a person with only a single disease.^{45,52,53} This tendency may also occur in those with depressive symptoms. The perception of severity can lead to high levels of health awareness and treatment adherence. However, these differences give room for further investigation of such issues. Hence, further studies are required to analyze these associations.

Strengths and Limitations

This study has several strengths. First, it is based on the IFLS survey, a large population-based study representing 83% of the Indonesian population. Second, we followed the STROBE guidelines in reporting for a systematic and transparent report.³² Third, we analyzed various types of chronic diseases to provide a comprehensive picture of chronic diseases in Indonesia. Fourth, we followed the conceptual framework of the WHO for data analysis that considers several strong determinants related to treatment nonadherence.¹⁰

Alternatively, several limitations should be acknowledged. First, the use of secondary data in this study limits the number of exposure factors potentially associated with the study outcome and the definitional settings of each variable. As such, our study did not include nonadherence on the initiation and implementation step of treatment regimen. Second, the self-reported questionnaires for measuring nonadherence may be prone to social desirability bias. Third, the cross-sectional design may limit the evaluation of causal relationships between the exposure and the outcome variables among subjects, as both were examined simultaneously.⁵⁴

Implication for Policy and Practice

The findings echo the urgent need to reduce the prevalence of treatment nonadherence by improving adherence rates to treatments for chronic diseases. In general, the study highlights two significant points. First, chronic diseases influence all dimensions of people's lives in Indonesia. Second, the majority of people with chronic diseases overlook the role of treatment in controlling chronic diseases, particularly NCDs. Given the threat posed by chronic diseases to public health and the economic development of countries,⁵⁵ a comprehensive strategy with a high-level framework-based approach that would better serve a broad range of chronic conditions is needed to overcome these problems. Preventive interventions should be developed in the form of policies, structural, and behavioral strategies.⁵⁶

From the results of our study, it was found that most of the predictors indicated that non-adherence to treatment was characterized by self-perceptions that they were in good health, causing them to think about not taking treatment and vice versa. The process of increasing patient's treatment adherence must then shift their perception of illnesses, acting as a basis of their subsequent behavior.²¹ As patient's belief is primarily determined by their knowledge, doctors, nurses, and pharmacists should provide an extensive information of their disease prognosis and treatment to improve their medication adherence.²¹ However, this practice is rarely carried out in Indonesia.^{57,58} Consequently, we emphasize the importance of counseling the patients as the first fundamental step to tackling the problem and empowering patients' self-management.

Noting the multitude of factors influencing patient's adherence, interventions for improving treatment adherence should be personalized according to patient's needs.^{10,50,59,60} This notion underlines the need for collaborative healthcare practices among medical doctors, nurses, and pharmacists to manage individual problems of nonadherence among patients with chronic diseases. However, the involvement of healthcare professionals in patient education is still lacking due to limited knowledge, limited human resources, time constraints, and the burden of administration.⁵⁷

Therefore, we also highlight the importance of accessibility to qualified health services to provide patients the knowledge needed in managing their chronic diseases and treatments.⁶¹ Healthcare professional should engage in managing patient's treatment adherence.²¹ Hence, it is necessary to educate and train healthcare professionals and adjust their workload and number to improve the management of chronic diseases.

Conclusion

Treatment nonadherence among patients with chronic diseases continues to be a challenge in Indonesia. The high rate of treatment nonadherence among chronic disease patients emphasized the need for a patient-centered care in adherence management. Considerable attention should be given to younger patients aged with a lower severity of the chronic disease, living in a rural areas, having positive health perception, and are active or nonsmokers. No one-size-fits-all intervention exists; thus, targeted and tailored interventions should be developed to improve treatment nonadherence. In efforts to improve adherence management, further studies need to develop and utilize a more comprehensive assessment instruments in gathering further data on medication nonadherence subtypes and its associated factors.

Data Sharing Statement

The IFLS-5 dataset analyzed for this study can be found at <https://www.rand.org/well-being/social-and-behavioral-policy/data/FLS/IFLS/access.html>.

Ethical Statements

No ethical approval is needed in this study since this is a database study using a public database with anonymous data. However, all activities followed the ethical principles in the Declaration of Helsinki. The fifth Indonesian Family Life Survey has obtained ethical approval from the Institutional Review Boards of RAND Corporation in the United States and Universitas Gadjah Mada in Indonesia. Consent for participation was handled by the conducting parties.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

All authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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