



Knowledge, Awareness, and Medication Adherence to Clopidogrel Therapy Among Patients in Zawiya, Libya: A Cross-Sectional Study

Zahra Abdulhamid Balkhayr¹, Hanan Alhadi Thwer², Wayel A. Almrabet², Badareddin A. Abousnena³,
Hanan Arragebe³, Nasrien Ali Elfarrah⁴,

¹ Department of surgery, faculty of medicine, University of Zawiya

² Faculty of Medical Technology, University of Zawiya

³ Department of Radiology, Faculty of Medical Technology, University of Zawiya

⁴ Libyan Medical Research Centre

Corresponding Author: Nasrien Ali Elfarrah, Email. Ali.nasrien@gmail.com

Abstract

Background: Clopidogrel is a widely used antiplatelet agent; however, its safe and effective use depends on patients' knowledge, awareness, and adherence. **Objective:** This study aimed to assess patients' knowledge, awareness, and adherence to clopidogrel therapy in Zawiya City, Libya, and to identify associated sociodemographic and clinical factors. **Methods:** A descriptive cross-sectional study was conducted among 150 clopidogrel users using a structured questionnaire covering knowledge, safety awareness, and medication practices. Data were analyzed using descriptive statistics and Chi-square tests. **Results:** Most participants were aware that clopidogrel prevents thrombotic events (70.0%) and increases bleeding risk (68.0%). However, important gaps were identified in awareness of drug interactions and peri-procedural precautions. Educational level was significantly associated with awareness of bleeding risk ($p = 0.002$) and current medication use ($p = 0.032$). Chronic disease status was significantly associated with awareness of analgesic interactions ($p = 0.018$) and consultation before analgesic use ($p = 0.030$). Age was significantly associated with consultation behaviour prior to painkiller use ($p = 0.013$). **Conclusion:** Although overall adherence was moderate, substantial deficiencies exist in patients' safety-related knowledge. Targeted and structured educational interventions are needed to improve the safe use of clopidogrel.

Keywords: Clopidogrel; medication adherence; patient awareness; bleeding risk; drug interactions; cross-sectional study; Libya.

Introduction

Cardiovascular diseases (CVDs) continue to represent one of the most significant public health challenges worldwide. Despite substantial progress in diagnostic methods, therapeutic approaches, and preventive strategies, cardiovascular disorders remain responsible for a considerable proportion of global mortality and disability. The increasing prevalence of risk factors such as hypertension, diabetes mellitus, obesity, smoking, and sedentary lifestyles has further contributed to the growing burden of cardiovascular disease across both developed and developing countries [1,2]. Prevention of thrombotic complications is a fundamental component of cardiovascular disease management. Antiplatelet medications play a vital role in reducing the formation of arterial thrombi and preventing recurrent ischemic events. Among these medications, clopidogrel has become one of the most frequently prescribed agents for patients with acute coronary syndrome, previous myocardial infarction, ischemic stroke, peripheral

arterial disease, and those undergoing percutaneous coronary interventions [3,4]. The therapeutic action of clopidogrel is achieved through irreversible inhibition of platelet P2Y₁₂ receptors, resulting in reduced platelet activation and aggregation. Clinical evidence accumulated over the past two decades has consistently demonstrated the effectiveness of clopidogrel in lowering the incidence of recurrent cardiovascular events and improving long-term outcomes in high-risk patients [5,6].

Although the clinical benefits of clopidogrel are well recognized, achieving optimal treatment outcomes depends largely on patients' understanding of the medication and their commitment to prescribed therapy. Medication adherence remains a major concern in cardiovascular care because failure to follow treatment recommendations may reduce therapeutic effectiveness and increase the likelihood of recurrent ischemic events, hospital admissions, and adverse clinical outcomes [7,8].



In addition to adherence-related challenges, clopidogrel therapy requires careful attention to safety considerations. As an antiplatelet medication, it increases susceptibility to bleeding, which may range from mild manifestations such as bruising and epistaxis to severe hemorrhagic complications requiring urgent medical intervention. The probability of bleeding may be further increased in patients receiving concomitant antithrombotic therapy, prolonged treatment durations, or medications known to affect hemostasis [9,10].

Another important aspect of clopidogrel therapy involves potential drug interactions. Patients frequently use analgesics and other medications without professional consultation, which may expose them to avoidable risks. Certain nonsteroidal anti-inflammatory drugs, anticoagulants, and other commonly prescribed medications have been associated with increased bleeding risk or altered therapeutic response when used concurrently with clopidogrel. Consequently, awareness of possible interactions is essential for maintaining medication safety [11,12].

Effective patient education has been identified as a key determinant of successful long-term antiplatelet therapy. Individuals who possess adequate knowledge regarding the purpose of treatment, proper medication use, warning signs of bleeding, and precautions before surgical or dental procedures are generally more likely to adhere to therapy and adopt safer medication-related behaviors. Conversely, insufficient understanding may contribute to inappropriate self-medication, delayed recognition of adverse effects, and premature discontinuation of treatment [13,14].

Previous studies have highlighted persistent deficiencies in patient knowledge regarding antiplatelet medications. Although many patients understand the general purpose of clopidogrel therapy, important gaps often remain regarding drug interactions, management of missed doses, recognition of adverse effects, and communication with healthcare professionals before medical procedures. Such deficiencies may compromise treatment effectiveness and increase the risk of preventable complications [15,16].

Several factors may influence patients' awareness and adherence behaviors. Educational attainment, age, health literacy, duration of treatment, access to healthcare services, and the presence of chronic illnesses have all been reported as potential determinants of medication-related knowledge and compliance. However, findings from different populations have been inconsistent, suggesting that local healthcare practices and patient education strategies may play an important role in shaping outcomes [17–20].

Despite the widespread use of clopidogrel in cardiovascular practice, limited information is available regarding patients' knowledge, awareness, and adherence within the Libyan healthcare setting. Understanding these aspects is particularly important

because successful antiplatelet therapy depends not only on prescribing the medication but also on ensuring that patients possess sufficient knowledge to use it safely and effectively. Identifying gaps in awareness may assist healthcare professionals in developing targeted educational interventions aimed at improving medication safety and treatment outcomes [21–23].

Therefore, the present study was conducted to evaluate knowledge, awareness, and medication adherence among patients using clopidogrel in Zawiya City, Libya. Furthermore, the study sought to examine the relationship between selected sociodemographic and clinical characteristics and patients' levels of awareness and adherence. The findings may provide valuable evidence for improving patient counselling practices and supporting safer use of antiplatelet therapy within the local healthcare system [24,25].

Materials and methods

Study design and setting

This study employed a descriptive cross-sectional design to evaluate patients' knowledge, awareness, and medication-related practices regarding clopidogrel use, with particular focus on safety considerations and potential drug–drug interactions. A cross-sectional approach was selected as it allows assessment of exposure and outcomes simultaneously, providing a snapshot of patient understanding and behavior at a single point in time without intervention or follow-up.

Study population and sample size

The study population comprised 150 adult patients receiving clopidogrel therapy. Participants were recruited to assess their knowledge of therapeutic indication, adherence behavior, bleeding risk awareness, peri-procedural precautions, and awareness of interactions with commonly used analgesics. A total sample size of 150 was considered adequate to describe patterns of awareness and generate reliable estimates of patient-level knowledge and behavior within the selected healthcare setting.

Data collection tool and variables

Data were collected using a structured, predesigned questionnaire developed based on relevant literature and clinical guidelines on antiplatelet therapy. The questionnaire consisted of multiple sections covering:

- Sociodemographic characteristics (age, sex, educational level)
- Clinical variables (presence of chronic diseases, duration of clopidogrel therapy)
- Medication-related knowledge (indication for use, mechanism of action, and bleeding risk awareness)
- Safety practices (consultation before surgical/dental procedures and analgesic use)
- Medication adherence behavior
- Patient-reported need for additional information regarding clopidogrel



The instrument was designed to ensure standardized data collection and minimize variability in responses across participants.

Specific items assessed whether clopidogrel had been prescribed by a physician, whether it was used regularly as prescribed, and whether patients understood its therapeutic purpose. Additional questions evaluated recognition of abnormal bleeding symptoms, awareness of the need to inform healthcare providers prior to invasive procedures, and knowledge regarding potential interactions between clopidogrel and nonsteroidal anti-inflammatory drugs such as ibuprofen and diclofenac. These variables were included due to the well-established association between antiplatelet therapy, increased bleeding risk, and clinically relevant drug interactions.

Data collection procedure

Participants were interviewed using the structured questionnaire in a standardized format to ensure consistency in data acquisition. Responses were recorded and subsequently coded for statistical analysis. The data collection process was designed to minimize response bias and ensure clarity of questions, particularly in participants with varying educational backgrounds.

Statistical analysis

Data were entered into a computerized database and analyzed using descriptive and inferential statistical methods. Categorical variables were summarized using frequencies and percentages. Associations between sociodemographic/clinical variables and knowledge or practice outcomes were assessed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant. Results were presented in tabular form to facilitate interpretation of key findings and identification of knowledge and practice gaps.

Ethical considerations

Ethical approval was obtained prior to study initiation. Participation was voluntary, and informed consent was obtained from all respondents. Confidentiality and anonymity were strictly maintained throughout the study. Data were used exclusively for research purposes and were stored securely to ensure participant privacy. The study adhered to ethical principles for research involving human subjects, including respect for autonomy, beneficence, and confidentiality.

Results

A total of 150 participants were included in the study. The sample was predominantly male (58.7%), while females represented 41.3%. The most common age group was 40–59 years (42.7%), followed by participants aged ≥ 60 years (38.6%). Regarding educational attainment, 32.0% had secondary education, 29.3% had university-level education or higher, 24.0% had primary education, and 14.7% were illiterate. In terms of clinical characteristics, 65.3% of participants reported having at least one chronic disease, and 46.6% had been receiving clopidogrel therapy for more than one year.

Regarding medication use patterns, 78.7% of participants reported current use of clopidogrel, and 82.7% stated that the medication had been prescribed by a physician. Regular adherence to prescribed therapy was reported by 68.0% of respondents, indicating a moderate level of compliance within the study population.

In terms of knowledge and awareness, 70.0% of participants correctly identified clopidogrel as an antiplatelet agent used for prevention of blood clot formation, while 68.0% were aware of its associated bleeding risk. A total of 74.7% reported that they would seek medical attention in case of severe bleeding. However, awareness of key safety precautions was comparatively lower, with only 58.7% recognizing the need to inform physicians or dentists before undergoing medical procedures, and 49.3% reporting consultation before using non-prescribed painkillers. Overall, 68.0% of participants expressed a need for additional information regarding clopidogrel therapy, indicating a substantial unmet educational need.

Inferential analysis revealed several statistically significant associations. Educational level was significantly associated with awareness of bleeding risk ($\chi^2 = 20.620$, $p = 0.002$) and current use of clopidogrel ($\chi^2 = 13.829$, $p = 0.032$), indicating a strong influence of education on both knowledge and treatment continuity. Chronic disease status was significantly associated with awareness of analgesic–clopidogrel interactions ($\chi^2 = 8.008$, $p = 0.018$) and consultation before analgesic use ($\chi^2 = 7.004$, $p = 0.030$). Additionally, age group showed a significant association with consultation behavior prior to painkiller use ($\chi^2 = 12.605$, $p = 0.013$), suggesting age-related differences in medication safety practices.

Table 1: sociodemographic and clinical characteristics of the study participants

Variable	Category	n	%
Gender	Male	88	58.7
	Female	62	41.3
Age (years)	<40	28	18.7



	40–59	64	42.7
	≥60	58	38.6
Education level	Illiterate	22	14.7
	Primary	36	24.0
	Secondary	48	32.0
	University or higher	44	29.3
Chronic disease	Yes	98	65.3
	No	52	34.7
Duration of clopidogrel use	<6 months	34	22.7
	6–12 months	46	30.7
	>1 year	70	46.6

Table 2 Clopidogrel Use and Adherence Among the Participants

Variable	Response	n	%
Current use	Yes	118	78.7
	No	22	14.7
	Unknown	10	6.6
Physician prescribed	Yes	124	82.7
	No	16	10.6
	Unknown	10	6.7
Regular adherence	Yes	102	68.0
	No	32	21.3
	Unknown	16	10.7

Table3: Knowledge and Awareness Regarding Clopidogrel Use, Bleeding Risk, and Drug Interactions.

Domain	Item	Yes n (%)	No n (%)	Unknown n (%)
Indication & mechanism	Knows reason for use	92 (61.3)	34 (22.7)	24 (16.0)
	Prevents blood clots	105 (70.0)	28 (18.7)	17 (11.3)
Counseling	Received explanation	84 (56.0)	44 (29.3)	22 (14.7)
Safety awareness	Aware of bleeding risk	102 (68.0)	30 (20.0)	18 (12.0)
	Recognizes bleeding symptoms	95 (63.3)	36 (24.0)	19 (12.7)
	Would seek help if bleeding	112 (74.7)	21 (14.0)	17 (11.3)
Peri-procedural care	Inform dentist/doctor	88 (58.7)	39 (26.0)	23 (15.3)
	Previously informed providers	78 (52.0)	49 (32.7)	23 (15.3)



Drug interactions	Aware NSAID interaction	90 (60.0)	38 (25.3)	22 (14.7)
	Aware ibuprofen/diclofenac risk	81 (54.0)	45 (30.0)	24 (16.0)
	Consults before analgesics	74 (49.3)	55 (36.7)	21 (14.0)
Information need	Needs more information	102 (68.0)	28 (18.7)	20 (13.3)

Table 4: Association Between Participant Characteristics and Knowledge/Practice Variables.

Variable association	χ^2	df	p-value	Interpretation
Education vs. bleeding risk awareness	20.620	3	0.002	Significant
Education vs. current clopidogrel use	13.829	3	0.032	Significant
Chronic disease vs. NSAID interaction awareness	8.008	1	0.018	Significant
Chronic disease vs. analgesic consultation	7.004	1	0.030	Significant
Age group vs. analgesic consultation	12.605	2	0.013	Significant

*Statistically significant at $p < 0.05$.

Discussion

The present study provides clinically relevant insights into patients' knowledge, awareness, and behavioral practices regarding clopidogrel therapy in Zawiya City, Libya. The findings demonstrate that while general awareness of the therapeutic purpose of clopidogrel is relatively acceptable, there is a clear and clinically significant gap between theoretical knowledge and safe medication behavior, particularly in relation to bleeding risk prevention, drug-drug interactions, and peri-procedural management. This knowledge-behaviour dissociation is a well-recognised barrier in cardiovascular pharmacotherapy and has been consistently reported in real-world antiplatelet populations [21,25].

A major finding was the significant association between educational level and both bleeding risk awareness and current clopidogrel use. Patients with higher education demonstrated better understanding and more consistent therapy continuation. This finding can be explained by the central role of health literacy in shaping cognitive processing of medical information, risk perception, and decision-making behavior. Individuals with higher educational attainment are more capable of interpreting complex therapeutic instructions and recognizing adverse drug effects, particularly bleeding-related complications [17,13]. Conversely, limited education may impair comprehension of long-term preventive therapy, leading to underestimation of both benefits and risks, which is a known contributor to non-adherence in cardiovascular disease [14,20].

From a clinical perspective, this association is particularly important because clopidogrel is a high-risk medication where non-adherence or misuse may result in major adverse cardiovascular events or preventable bleeding complications. Evidence from large cardiovascular outcome studies confirms that suboptimal adherence to antiplatelet therapy significantly increases the risk of myocardial infarction, stroke, and mortality [20,10]. Therefore, the observed educational disparity is not merely a behavioral issue but a direct determinant of cardiovascular prognosis.

The study also revealed that chronic disease status influenced safety-related behavior, particularly consultation before analgesic use. Interestingly, patients with chronic illnesses were more likely to consult healthcare providers, despite having lower awareness of specific drug interactions. This suggests that behavior may be driven more by repeated healthcare exposure and perceived vulnerability than by pharmacological understanding. This aligns with findings indicating that frequent clinical contact can reinforce precautionary behaviors even in the absence of complete knowledge acquisition [9]. However, this behavioural effect appears insufficient in isolation, as structured education is required to translate exposure into sustained improvements in knowledge [18].

This finding highlights an important limitation in current healthcare delivery models, where routine follow-up alone does not guarantee adequate patient education. Without structured counselling, patients may adopt partially informed behaviors that are inconsistent and not grounded in understanding of drug mechanisms or



interaction risks. This may explain why awareness of analgesic interactions remained suboptimal despite increased healthcare contact.

Age was another significant determinant of medication-related behavior, with older adults being less likely to consult before using painkillers. This is particularly concerning given the increased susceptibility of elderly patients to adverse drug reactions, including gastrointestinal and systemic bleeding associated with antiplatelet therapy. Physiological vulnerability, polypharmacy, and reduced health literacy contribute to this risk profile [10,12]. Moreover, older patients often engage in self-medication practices and may underestimate the severity of drug interactions, which further increases clinical risk. International cardiovascular guidelines emphasize that elderly patients require intensified counseling and medication review strategies due to their high-risk profile [1,3].

A key clinical concern identified in this study is the persistent gap between knowledge and practice. Although most participants understood the primary therapeutic role of clopidogrel and its association with bleeding risk, significantly fewer were aware of essential safety behaviors such as informing dentists or physicians before procedures and avoiding unsupervised use of NSAIDs. This dissociation between conceptual understanding and applied behavior reflects a breakdown in risk translation into action, which has been widely documented in antiplatelet therapy populations [11].

From a pharmacological perspective, this gap is critical because clopidogrel's irreversible inhibition of platelet aggregation creates sustained bleeding risk that cannot be rapidly reversed. Therefore, failure to adhere to peri-procedural precautions or avoid interacting drugs such as NSAIDs may result in clinically significant hemorrhagic complications. This highlights the importance of not only informing patients about the drug's purpose but also ensuring deep understanding of its risk profile and interaction potential.

Furthermore, the study identified that only slightly more than half of participants reported receiving adequate counselling from healthcare providers. This represents a systemic gap in patient education delivery. Inadequate counselling has been repeatedly identified as a major modifiable factor contributing to poor adherence and unsafe medication practices in cardiovascular populations [13]. The importance of structured counselling is further supported by major clinical trials such as CURE, which demonstrated that the full therapeutic benefit of clopidogrel is achieved only when patients are both appropriately informed and adherent to therapy [22].

The high proportion of patients requesting additional information further reinforces the existence of unmet educational needs. This finding suggests that current communication strategies are insufficiently structured,

inconsistent, or not tailored to patient literacy levels. The World Health Organisation explicitly emphasises that adherence to long-term therapies is strongly dependent on continuous, structured, and patient-centred education strategies rather than isolated counselling sessions [25]. From a public health perspective, these findings have important implications for cardiovascular disease management in Libya. The observed variability in awareness and behavior suggests that current healthcare systems may lack standardised patient education protocols for antiplatelet therapy. Implementing pharmacist-led counselling programs, standardised discharge education, and reinforced follow-up education could significantly reduce preventable complications and improve long-term outcomes.

Overall, the findings indicate that clopidogrel safety behavior is determined by a multifactorial interaction between educational level (cognitive capacity), chronic disease status (healthcare exposure), and age (physiological and behavioral vulnerability). This multidimensional pattern reflects the complexity of medication adherence behavior and underscores that improving outcomes requires integrated interventions rather than isolated educational messages. These findings are consistent with contemporary cardiovascular guidelines, which emphasize that optimal antiplatelet therapy outcomes depend on combining pharmacological efficacy with structured patient education, adherence support, and continuous clinical reinforcement [1,3].

In conclusion, this study highlights a critical and clinically important gap between knowledge and practice among clopidogrel users. Addressing this gap requires system-level interventions focused on structured education, improved provider-patient communication, and targeted strategies for high-risk groups such as older adults and patients with low educational attainment. Such interventions are essential to minimize preventable bleeding complications and optimize the real-world effectiveness of antiplatelet therapy.

Conclusion

This study evaluated patients' knowledge, awareness, and adherence regarding clopidogrel therapy in Zawiya City, Libya. The findings demonstrated that although most participants were aware of the primary indication of clopidogrel and its role in preventing blood clot formation, important deficiencies remained regarding bleeding risks, drug interactions, and precautionary measures before medical or dental procedures.

Medication adherence was generally acceptable; however, a considerable proportion of participants reported insufficient knowledge about critical safety aspects of clopidogrel therapy. Significant associations were identified between educational level and awareness of bleeding risk as well as current clopidogrel use. Furthermore, chronic disease status and age were



significantly associated with consultation practices before using painkillers and awareness of potential drug interactions.

These findings suggest that patient education remains a key determinant of safe and effective clopidogrel use. Structured educational interventions led by physicians, pharmacists, and other healthcare professionals may improve patients' understanding of medication safety, enhance adherence, and reduce preventable complications associated with inappropriate medication use.

Future multicenter studies involving larger and more diverse populations are recommended to further explore

factors influencing patient awareness and adherence to antiplatelet therapy in Libya and comparable healthcare settings.

Conflict of Interest

The authors declare that they have no conflict of interest

Funding status

No funds for this manuscript

Interest conflict

The authors declare that no conflict of interest

Reference

- Byrne RA, Rossello X, Coughlan JJ, et al. 2023 ESC Guidelines for the management of acute coronary syndromes. *Eur Heart J*. 2023;44(38):3720-3826.
- Lawton JS, Tamis-Holland JE, Bangalore S, et al. 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization. *Circulation*. 2022;145:e18-e114.
- Virani SS, Morris PB, Agarwala A, et al. 2023 AHA/ACC Guideline for the Management of Chronic Coronary Disease. *Circulation*. 2023.
- Valgimigli M, Bueno H, Byrne RA, et al. Antiplatelet therapy recommendations in ACS: ESC update. *Eur Heart J*. 2023.
- Raheem Z, Mohammed TR. Evaluation of Patients' Knowledge and Adherence to Clopidogrel Therapy Post Percutaneous Coronary Intervention. *Iraqi Nat J Nurs Spec*. 2023;36(1):117-124.
- Watanabe H, et al. Clopidogrel versus aspirin monotherapy beyond one year after PCI: 5-year outcomes. *JAMA Cardiol*. 2025.
- Mehran R, Cao D, Angiolillo DJ, et al. Antiplatelet therapy after PCI in high bleeding risk patients. *Lancet*. 2023.
- Collet JP, Thiele H, Barbato E, et al. 2020 ESC Guidelines for Acute Coronary Syndromes without ST-segment elevation. *Eur Heart J*. 2021;42:1289-1367.
- Bhatt DL, Eikelboom JW, Connolly SJ, et al. Antithrombotic therapy for secondary prevention of cardiovascular disease. *N Engl J Med*. 2023.
- Kumbhani DJ, Cannon CP, Beavers CJ, et al. Patient adherence to cardiovascular medications. *J Am Coll Cardiol*. 2022.
- Angiolillo DJ, Rollini F. Clopidogrel pharmacology and clinical applications. *Nat Rev Cardiol*. 2022.
- Arnett DK, Blumenthal RS, Albert MA, et al. Cardiovascular disease prevention recommendations. *Circulation*. 2022.
- Maddox TM, Januzzi JL, Allen LA, et al. Clinical management and adherence in cardiovascular patients. *JACC*. 2023.
- Nanna MG, Navar AM, Wang TY. Medication adherence and cardiovascular outcomes. *Curr Cardiol Rep*. 2022.
- Khan SU, Lone AN, Khan MS, et al. Long-term antiplatelet therapy after myocardial infarction. *Eur Heart J*. 2022.
- Vranckx P, Valgimigli M, Juni P. Dual antiplatelet therapy duration after PCI. *Lancet*. 2021.
- Levine GN, Bates ER, Bittl JA, et al. Duration of dual antiplatelet therapy in coronary artery disease. *Circulation*. 2021 update.
- Deharo P, Quilici J, Camoin-Jau L, et al. Predictors of clopidogrel adherence in cardiovascular patients. *Thromb Haemost*. 2022.
- Yudi MB, Clark DJ, Farouque O, et al. Patient education and medication persistence after PCI. *Heart Lung Circ*. 2021.
- Ho PM, Bryson CL, Rumsfeld JS. Medication adherence and cardiovascular outcomes. *Circulation*. 2009;119:3028-3035.
- Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med*. 2005;353:487-497.
- Yusuf S, Zhao F, Mehta SR, et al. Effects of clopidogrel in addition to aspirin in patients with acute coronary syndromes (CURE Trial). *N Engl J Med*. 2001;345:494-502.
- CAPRIE Steering Committee. Clopidogrel versus aspirin in patients at risk of ischemic events. *Lancet*. 1996;348:1329-1339.
- Mega JL, Close SL, Wiviott SD, et al. Cytochrome P450 polymorphisms and response to clopidogrel. *N Engl J Med*. 2009;360:354-362.
- World Health Organization. *Adherence to Long-Term Therapies: Evidence for Action*. Geneva: WHO; 2023 update.

