**Knowledge about Malaria and Antimalarial Drug Dispensing Practices among Medication Vendors in the Dschang Health District**

**Abstract:**

**Background:** In Africa, medication vendors (MVs) in the informal sector play a key role in distributing antimalarial treatments, thereby complementing formal healthcare services. However, their lack of knowledge and irrational practices present major risks, notably drug resistance and adverse effects. This study aimed to assess the level of knowledge about malaria and the practices of antimalarial drug dispensing among medication vendors in the Dschang health district (DHD) in Cameroon.

**Method:** This was a cross-sectional study targeting MVs. They were recruited through exhaustive sampling across all health areas of the DHD. Data were collected using a semi-structured questionnaire, entered with CSPro 7.7 software, and analyzed using SPSS 23. Multivariate logistic regression was applied to identify factors associated with poor practices.

**Results:** Of the 105 MVs included in our study, only 32.4% had good knowledge about malaria. Regarding practices, 62% dispensed antimalarials incorrectly, 40% without a prescription for oral forms and 17.1% for injectables. The main factors associated with poor practices were insufficient knowledge (aOR = 7.22; 95% CI: 2.12–24.59; p=0.002) and lack of health training (aOR = 8.08; 95% CI: 2.12–30.69; p=0.002).

**Conclusion:** The results reveal deficiencies in knowledge and practices among MVs, increasing the risks of resistance and misuse of antimalarials. There is an urgent need to strengthen their training, supervise their activities, and raise community awareness about the rational use of medication. These measures are essential for improving malaria management and reducing its burden in the region.

**Keywords:** knowledge, malaria, antimalarial drugs, medicine vendors, Dschang health district.

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# Introduction

Malaria is an acute febrile illness caused by parasites of the Plasmodium genus, transmitted to humans through the bites of infected female Anopheles mosquitoes [1]. Despite global control efforts, malaria remains a major public health issue in tropical and subtropical regions, particularly in sub-Saharan Africa (SSA), which accounted for 93% of cases and 67% of malaria-related deaths in 2019 [1,2]. In Cameroon, malaria accounts for over 30% of medical consultations and is the third leading cause of death, after HIV/AIDS and neonatal infections [3]. It places a heavy burden on the healthcare system and household economies, absorbing 40 to 45% of annual income spent on healthcare [4] with an estimated direct cost of 12 billion US dollars per year [5]. According to the 2019 annual report from the National Malaria Control Program (NMCP), the disease is responsible for 22% of annual deaths in Cameroon [6].

Although significant progress has been made in the fight against malaria with a 21% reduction in incidence and 29% in mortality between 2010 and 2015 [7], the emergence of resistance to antimalarial drugs and insecticides threatens these gains [8]. Such resistance is driven by inappropriate practices such as irrational prescription and dispensing of drugs, diagnostic errors, incorrect dosages, and self-medication [9].

Indeed, in many developing countries, the private sector plays a significant role, accounting for 40 to 60% of healthcare-seeking visits [[1](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5845369/#CR1)]. Informal medication vendors (MVs) are crucial in ensuring access to antimalarial treatments due to their availability, geographical accessibility, and flexible hours [10]. However, these actors often lack knowledge of recommended therapeutic protocols, leading to improper drug use [9, 11].. This situation increases the risk of resistance and adverse effects, jeopardizing disease control efforts.

Concerns thus arise over the knowledge levels of MVs, which directly affect the rational use of antimalarial drugs and the control of drug resistance. This study aimed to evaluate the level of knowledge of medication vendors in the Dschang Health District (DHD) regarding the aetiology, transmission, clinical presentations, treatment, and prevention of malaria, in conjunction with their understanding of the conditions for dispensing antimalarial drugs.

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### Methodology

**Study Design and Period**

This was a cross-sectional study conducted from September 2023 to July 2024 in the Dschang Health District (West Region, Cameroon). This district made up of 22 health areas and an estimated population of 243,182 inhabitants, was selected for its geographic and demographic representativeness.

**Study Population and Sampling**

The study targeted all medication vendors (MVs) operating in the district, who were recruited exhaustively. Excluded from the study were MVs who did not consent to participate due to lack of time or distrust. Of the 118 MVs approached, 105 agreed to participate in the study.

**Data collection**

A semi-structured questionnaire, pre-tested in the neighbouring Penka-Michel district, was administered face-to-face by the principal investigator. The collected data included: sociodemographic variables (age, sex, education level, professional experience, type of sales point); knowledge about malaria (transmission, symptoms, diagnosis, prevention, recommended treatments including dosages of Artemisinin-based Combination Therapies [ACT] and injectable artesunate) and dispensing practices (frequency of requiring a prescription, alternative criteria used such as symptoms, rapid diagnostic tests [RDTs], client request).

## Definition of operational terms

**Health policy knowledge** is defined as the set of information acquired by individuals on a given health issue [13]. It is often used to measure community understanding of public health concepts relevant to national and international health issues [14].

**Medicine** is any substance, drug, or chemical compound presented as having curative or preventive properties for human or animal diseases. It also includes any product that can be administered to humans or animals to establish a medical diagnosis or restore, correct, or modify an organic function. Also considered as medicines are dietary products that contain chemical or biological substances which themselves may not be medicines but whose properties confer therapeutic dietary value or function as test meals[15, 16].

### Table 1 : Percentage score appreciation levels

|  |  |  |
| --- | --- | --- |
| Variables | Percentage |  Category |
| Knowledge  | < 50 % |

|  |
| --- |
|  Poor knowledge |

 |
| [50 ; 65[ |

|  |  |  |
| --- | --- | --- |
|  |  | Insufficient knowledge |

 |
| [65 ; 85[ |

|  |  |  |
| --- | --- | --- |
|  |  | Moderate knowledge |

 |
| ≥ 85 % |

|  |  |  |
| --- | --- | --- |
|  |  | Good knowledge |

 |
| Practices | < 50 % |

|  |  |  |
| --- | --- | --- |
|  |  | Harmful practices |

 |
| [50 ; 80[ |

|  |  |  |
| --- | --- | --- |
|  |  | Inadequate practices |

 |
| ≥ 80 % |

|  |  |  |
| --- | --- | --- |
|  |  | Adequate practices |

 |

### Data Analysis

Data were entered using CSPro 7.7 and analyzed with SPSS version 23. Results were presented as means (for quantitative variables) and proportions (for qualitative variables), with 95% confidence intervals. The data analysis followed the framework of a Knowledge, Attitudes, and Practices (KAP) survey as published in the work of Essi and Njoya [12]. Logistic regression was used to identify factors associated with poor practices (both crude and adjusted odds ratios). A significance threshold of p < 0.05 was used.

Ethical considerations

The study was approved by the Faculty of Medicine and Pharmaceutical Sciences of the University of Dschang, the Regional Committee of Ethics for Human Health Research of the West (CRERSH-OU) and was authorized by the Dschang Health District. Participants provided written informed consent, and data anonymity was ensured.

**Results**

### Survey coverage

The study was conducted across all 22 health areas of the Dschang health district. Of the 118 medication vendors approached, 13 refused to participate, and 105 were included. Figure 1 shows the participant inclusion flowchart.

**Vendors**

**approached**

n=118

**Participation**

n=105(88.98%)

**Participants included**

**in the analysis**

n=105 (88.98 %)

**Incomplete or**

**invalid**

**questionnaires**

n=0 (0%)

**Refusals**

n=13 (11.01%)

**Reasons for refusal**

-Lack of time n=02

-Fear of government agents disguised as students. n=11

### Figure 1: Study participants flowcharts

**Sociodemographic characteristics of Medication Vendors (MVs)**

### The study included 105 MVs, of whom 81% were men. Most were aged 20–39 years (67.6%). The majority operated from kiosks (78.1%), and 43.8% had no health qualification. The most represented trained professionals were state-registered nurses (19.05%) and nurse aids (17.14%).

### Table 2: Sociodemographic profiles of the MVs.

|  |  |  |  |
| --- | --- | --- | --- |
| Variable  | Frequency (N)  | Percentage (%) | 95% CI |
| Age |  |  |  |
| 20 − 39 years | 71 | 67.6 | 58.1- 77.1 |
| 40 − 59 years | 30 | 28.6 | 20 – 37.1 |
| 60 − 79 years | 4 | 3.8 | 1.0 – 7.6 |
| Sex |  |  |  |
| Male | 85 | 81.0 | 73.3- 87.6 |
| Female | 20 | 19.0 | 12.4 – 26.7 |
| Education |  |  |  |
| No schooling | 1 | 1.0 | 0.0 – 2.9 |
| Secondary | 54 | 51.4 | 41.9 – 61.0 |
| Higher/Tertiary | 50 | 47.6 | 3.1 – 57.1 |
| Years of experience |  |  |  |
|  < 10 years | 70 | 66.7 | 58.1 – 75.2 |
| >= 10 years  | 35 | 33.3 | 24.8 – 41.9 |
| Point of sale |  |  |  |
| Pharmacy  | 16 | 15.2 | 8.6 – 22.9 |
| General store  | 2 | 1.9 | 0.0 – 4.8 |
| Street vendor  | 5 | 4.8 | 1.0 – 8.6 |
| Kiosk | 82 | 78.1 | 69.5 – 85.7 |
| Health qualification |  |  |  |
| None | 46 | 43.8 | 34.3 – 53.3 |
| State registered nurse | 20 | 19.05 | 22.0 – 45.8 |
| Laboratory | 4 | 3.81 | 1.7 – 13.6 |
| Pharmacist | 12 | 11.43 | 10.2 – 30.5 |
| Nurse aid | 18 | 17.14 | 18.6 – 42.4 |
| Midwife | 5 | 4.76 | 1.7 – 15.3 |

#### Medication vendors knowledge of malaria.

All vendors (100%) knew that malaria is transmitted by mosquito bites. but only 25.7% correctly identified Plasmodium (a protozoan) as the causative agent. Rapid diagnostic tests (RDTs) were known by 80% of vendors. Common symptoms like fever were well recognized (92.4%), but knowledge of severe symptoms like convulsions was lower (46.7%).

### Table 3: medication vendors knowledge of malaria

|  |  |  |  |
| --- | --- | --- | --- |
| Variables  | Frequency (N) | Percentage (%) | 95% CI |
| Transmission of malaria |  |  |  |
| Dirty water | 0 | 0 | - |
| Mosquito bites  | 105 | 100.0 | 100 - 100 |
| Contact with a sick person  | 0 | 0 | - |
| Unprotected sex | 0 | 0 | - |
| Germ responsible |  |  |  |
| Virus | 0 | 0 | - |
| Protozoa | 27 | 25.7 | 18.1 – 35.2 |
| Mosquitoes | 76 | 72.4 | 62.9 – 81.0 |
| Bacteria | 2 | 1.9 | 0.0 – 4.8 |
| Biological diagnosis |  |  |  |
| Rapid diagnostic test (RDTs) | 84 | 80.0 | 71.5 - 87.6 |
| Thick drop | 46 | 43.8 | 34.3 – 53.3 |
| Symptoms | 9 | 8.6 | 3.8 – 14.3 |
| Blood pressure measurement | 0 | 0 | - |
| Patient statement  | 16 | 15.2 | 8.6 – 22.8 |
| Symptoms of uncomplicated malaria |  |  |  |
| Headache | 81 | 77.1 | 69.5 – 85.7 |
| Fever | 97 | 92.4 | 86.7 – 97.1 |
| Anaemia | 17 | 16.2 | 9.5 – 23.8 |
| Joint pain | 68 | 64.8 | 56.2 – 74.3 |
| Fatigue | 34 | 32.4 | 23.8 – 41.0 |
| Unconsciousness. | 2 | 1.9 | 0.0 – 4.8 |
| Vomiting  | 31 | 29.5 | 20.0 – 38.1 |
| Signs of severity |  |  |  |
| Headache | 15 | 14.3 | 7.6 – 21.0 |
| Fever | 35 | 33.3 | 23.8 – 41.9 |
| Anemia | 84 | 80.0 | 72.4 – 86.7 |
| Convulsions  | 49 | 46.7 | 37.1 – 57.1 |
| Coma. | 41 | 39.0 | 29.5 – 48.6 |
| Jaundice | 39 | 37.1 | 27.6 – 46.6 |
| Population most vulnerable to malaria |  |  |  |
| Children under 5 | 49 | 46.7 | 37.1 – 55.2 |
| Adolescents | 22 | 21.0 | 14.3 – 29.5 |
| Pregnant women | 32 | 30.5 | 21.0 – 40.0 |
| People with HIV  | 16 | 15.2 | 8.6 – 22.8 |
| Adults | 5 | 4.8 | 1.0 – 9.5 |
| Preventing malaria  |  |  |  |
| Safe sex  | 1 | 1.0 | 0.0 – 2.9 |
| Use of insecticide and LLINs\* | 95 | 90.5 | 84.8 – 95.2 |
| Avoid dirty water  | 16 | 15.2 | 8.6 – 22.9 |
| Clean environment | 55 | 52.4 | 41.9 – 61.9 |
| Sulfadoxine-Pyrimethamine (SP) | 53 | 50.5 | 41.9 – 60.0 |
| Anti-malarial drugs  |  |  |  |
| Quinine | 95 | 90.5 | 84.8 – 96.2 |
| ACT; | 65 | 61.9 | 52.4 – 71.4 |
| Antibiotics | 13 | 12.4 | 6.7 – 20.0 |
| Paracetamol | 36 | 34.3 | 24.8 – 43.8 |
| Diclofenac | 4 | 3.8 | 1.0 – 7.6 |
| Handicrafts | 5 | 4.8 | 1.0 – 9.5 |

### \*LLINs: long-lasting acting impregnated mosquito nets

### Knowledge of 1st-line antimalarial drugs and dosage.

### Artemether-lumefantrine was correctly identified as the first-line treatment by 81.9% of vendors for uncomplicated malaria, but only 60% knew about injectable artesunate for severe cases. 28.6% didn’t have knowledge on the correct dosage for adults and 31.4% on the correct dosage for children aged 5 and below (Table 4).

### Table 4: medication vendors knowledge of first-line antimalarial treatment and dosage.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables  | Category | Frequency (N) | Percentage (%) | 95% CI |
| The antimalarial recommended as 1st-line treatment for uncomplicated malaria | SP | 1 | 1.0 | 0.0 – 2.9 |
| Chloroquine; | 2 | 1.9 | 0.0 – 4.8 |
| Artemether / lumefantrine  | 86 | 81.9 | 74.3 – 88.6 |
| Artesunate amodiaqune  | 5 | 4.8 | 1.0 – 9.5 |
| Quinine | 10 | 9.5 | 4.8 – 15.2 |
| Amodiaquine | 1 | 1.0 | 0.0 – 2.9 |
| Knowledge of dosage for adults | Yes | 75 | 71.4 | 62.9 – 80.0 |
| No | 30 | 28.6 | 20.0 – 37.1 |
| Knowledge of dosage for children under 5 years of age | Yes | 70 | 66.7 | 58.1 – 75.2 |
| No | 33 | 31.4 | 22.9 – 40.0 |
| The antimalarial recommended as 1st line treatment for severe malaria | SP | 1 | 1.0 | 0.0 – 2.9 |
| Chloroquine | 2 | 1.9 | 0.0 – 4.8 |
| Injectable artemether | 26 | 24.8 | 17.1 – 33.3 |
| Quinine infusion | 13 | 12.4 | 6.7 – 19.0 |
| Injectable artesunate | 63 | 60.0 | 50.5 – 68.6 |
| Knowledge of dosage for an adult weighing 70kg | Yes | 30 | 28.6 | 20 – 37.1 |
| No | 75 | 71.4 | 62.9 – 80.0 |
| Knowledge of dosage for a child weighing less than 10kg | Yes | 28 | 26.7 | 18.1 – 35.2 |
| No | 77 | 73.3 | 64.8 – 81.9 |

Only 12.4% of the MVs had good knowledge regarding malaria treatment with 41.9% showing poor knowledge on the subject (Figure 2).

### Figure 2: knowledge of medication vendors regarding malaria

#### Conditions for Dispensing Oral and Injectable Antimalarials.

40% of the MVs never required a prescription. Only 4.8% always requested one. In the absence of a prescription: 50.5% conducted a rapid diagnostic test (RDT). 28.6% used symptom assessment, 16.2% dispensed based on customer request and 34.3% always required a prescription for injectable antimalarials.

**Table 5:** conditions for dispensing oral and injectable antimalarials by medication vendors.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Category | Frequency (N)  | Percentage (%) | 95% CI |
| Prescription required. n = 106  | Never | 42 | 40.0 | 30.5 - 49.5 |
| Rarely | 33 | 31.4 |  | 22.9 – 40.0 |
| Very often | 26 | 24.8 |  | 17.1 – 33.3 |
| Always | 5 | 4.8 |  | 1.0 – 8.6 |
| Dispensing condition when prescription not required. n= 100 | At the customer's request | 17 | 16.2 | 9.5 -23.8 |
| Based on symptoms | 30 | 28.6 | 20.0 – 38.1 |
| After a positive RDT | 53 | 50.5 | 41.0- 59.0 |
| Injectable antimalarials in stock n= 95 | Yes | 88 | 83.8 | 76.2 – 90.5 |
| No  | 17 | 16.2 | 9.5 – 23.8 |
| Frequency of prescription required n= 90  | Never | 18 | 17.1 | 10.5 – 24.8 |
| Rarely | 17 | 15.2 | 9.5 – 23.8 |
| Very often | 19 | 18.1 | 11.4 -25.7 |
| Always | 36 | 34.3 | 24.8 – 42.9 |
| Dispensing condition when prescription not required. n=53 | At the customer's request | 9 | 8.6 | 3.8 -14.3 |
| Based on symptoms  | 20 | 19.0 | 11.4 -26.7 |
| After a positive RDT | 24 | 22.9 | 15.2 – 30.5 |

55.2% of sellers had practices that were described as ‘harmful’ with only 38.1% having adequate practices. (Figure 3).

**Figure 3:** practices of medication vendors regarding malaria.

### Comparison of socio-demographic characteristics of DMVs with poor antimalarial drug dispensing practices.

### Table 6 shows a comparison of the socio-demographic characteristics of poorly practiced MVs dispensing antimalarial drugs. We note that the number of poorly trained MVs is higher than that of well-trained MVs: 36 (73.5%) compared to 13 (23.4%). The same applies to the percentage of poor knowledge. which is higher among those with poor practices than among those with good practices: 33 (71.7%) compared with 13 (28.3%). These results are significant, each with a p-value <0.001.

### Table 6: socio-demographic distribution of MVs with antimalarial drug dispensing practices.

|  |  |  |  |
| --- | --- | --- | --- |
| Category | Dispensing practices of anti-malarial drugs | Khi-2 | P-value |
| **Poor** **N (%)** | **Good** **N (%)** |
| Age |  |  |  |  |
| 20-39 years | 29 (56.9) | 22 (43.1) | 2.650 | 0.104 |
| >= 40 years | 11 (37.9) | 18 (62.1) |
| Sex |  |  |  |  |
| Male | 30 (46.2) | 35 (53.8) | 2.051 | 0.152 |
| Female | 10 (66.7) | 5 (33.3) |
| Education |  |  |  |  |
| Non schooling | 0 (0) | 1 (100) | 2.026 | 0.363 |
| Secondary | 24 (55.8) | 19 (44.2) |
| Higher/Tertiary | 15 (44.4) | 20 (55.6) |
| Years of experience |  |  |  |  |
| < 10 years | 26 (52.0) | 24 (48.0) | 0.213 | 0.644 |
| >= 10 years | 14 (46.7) | 16 (53.3) |
| Health training |  |  |  |  |
| Yes | 13(23.4) | 36 (73.5) | **27.860** | **<0.001** |
| No | 27 (87.1) | 4 (12.9) |
| Point of sale |  |  |  |  |
| Kiosk | 27 (41.5) | 38(58.5) | **9.928** | **0.002** |
| Others | 13 (86.7) | 2 (13.3) |
| Good knowledge |  |  |  |  |
| No | 33 (71.7) | 13 (28.3) | **20.460** | **<0.001** |
| Yes | 7 (20.6) | 27 (19.4) |

**Factors associated with poor antimalarial drug dispensing practices.**

Multivariate analysis revealed that poor knowledge increased the likelihood of poor practices by 7.22 (95% CI: 2.12-24.59) and lack of health training increased this by 8.08 (95% CI: 2.12-30.69). No significant association was found with age, gender or professional experience.

**Table 7:** Distribution of factors associated with poor dispensing practices among participants.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable  | p-value | OR  | (95% CI) | p-value | aOR  | (95% CI) |
| Knowledge |  |  |  |  |  |  |
| Poor  | <0.001 | 9.791 | 3.426-27.986 | **0.002** | 7.22 | 2.123-24.59 |
| Good | 1 |  |  |  |  |  |
| Health training |  |  |  |  |  |  |
| No  | <0.001 | 13.5 | 4.020 - 45.330 | **0.002** | 8.080 | 2.12-30.69 |
| Yes | 1 |  |  |  |  |  |
| Experience |  |  |  |  |  |  |
| < 10 yrs  | 0.357 | 1.535 | 0.617-3.819 |  |  |  |
| >= 10 yrs | 1 |  |  |  |  |  |

# Discussion

This study assessed the knowledge and practices of medication vendors (MVs) regarding the dispensation of antimalarial drugs in the Dschang health district of Cameroon. The findings reveal alarming gaps, with significant implications for malaria control efforts in this endemic region.

The MVs surveyed were mostly male (81%) and young (67.6% aged 20–39 years). This male predominance could be explained by socio-economic factors, particularly the easier access men often have to informal commercial activities in certain African contexts. Most vendors operated from kiosks (78.1%) rather than from formal pharmacies, which contrasts with observations from urban areas like Buea [9]. Nearly half of the participants (43.8%) had no health training, a finding consistent with reports from Ghana [10]. However, some MVs were former healthcare professionals (nurses, nurse aids), a situation also documented in Tanzania [4].

Although all vendors recognized that malaria is transmitted by mosquitoes, only 25.7% correctly identified the Plasmodium parasite as the causal agent, a common confusion in similar studies [9,10]. While the symptoms of uncomplicated malaria (such as fever and headaches) were widely known, knowledge about severe malaria symptoms (such as convulsions and coma) was more limited, an issue that aligns with findings from other studies [9]. In terms of treatment, 81.9% of vendors correctly cited artemether-lumefantrine as the first-line treatment for uncomplicated malaria. However, only 60% were aware that injectable artesunate is recommended for severe malaria. Knowledge of drug dosages was particularly poor, especially for injectables, where only 26.7% of vendors demonstrated correct understanding which was an issue also noted elsewhere [9].

The analysis revealed that poor knowledge (adjusted OR = 7.22, p = 0.002) and lack of health training (adjusted OR = 8.08, p = 0.002) were statistically significant factors associated with poor dispensing practices. These associations reinforce findings from other studies [9,11], which show that cognitive gaps are a key determinant of inappropriate practices. This suggests that experience alone, without adequate training, is insufficient to ensure safe and effective practices. These factors likely interact in complex ways, highlighting the need for multidimensional interventions.

**Strengths and limitations of the study**

The exhaustive sampling of medicine vendors (MVs) in the Dschang health district allowed for a comprehensive view of local practices. Furthermore, the choice of a semi-rural setting representative of the challenges faced in many sub-Saharan African regions gives the study strong regional relevance. However, this study has certain limitations. Its cross-sectional design does not allow the establishment of causal relationships. The self-reported nature of the data could lead to underestimation of poor practices due to social desirability bias. Future research that includes direct observation and analysis of economic determinants (such as vendor income or client pressure) would help deepen the findings.

# Conclusion

This study highlights significant gaps in the knowledge and practices of medication vendors regarding malaria management in Dschang. Results showed that nearly 70% of vendors had insufficient knowledge, and 62% engaged in inappropriate dispensing practices, particularly the sale of antimalarial drugs without a prescription. These findings underscore the urgent need for targeted interventions to improve training for informal sector actors and strengthen drug dispensing practices' regulation. Implementing the recommended actions such as ongoing training programs, stricter supervision, and public awareness campaigns could substantially improve the quality of care and contribute to the fight against malaria in the region. This study opens concrete avenues for optimizing the role of medication vendors within the local health system, while emphasizing the importance of integrated approaches that combine training, regulation, and public education.

**COMPETING INTERESTS DISCLAIMER:**

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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