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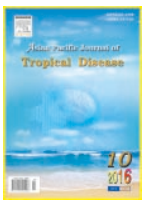

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# Prescription practices for non-malaria febrile illnesses among under-fives in the Lake Zone, Tanzania

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ABSTRACT

**Objective:** To determine prescription practices for non-malarial fever cases among febrile under-fives in the Lake Zone of Tanzania.

**Methods:** A health facility-based study was conducted in health facilities of the Lake Zone regions targeting 1 080 medical records. From patients' medical records, we collected information on how non-malarial fever was managed. Statistical analyses involved descriptive statistics and comparisons of proportions of prescribing medications between clinicians working in health facilities supported by Tibu Homa Project against others. Logistic regression analysis was used to assess independent variables associated with irregular prescription of antimalarials to non-malarial fever cases.

**Results:** The main clinical diagnoses among febrile under-fives tested negative for malaria were respiratory tract infections (17%), pneumonia (15%) and urinary tract infections (10%). Over-prescription of antimalarial was to 12% (95%, confidence interval: 10%–14%) and only 14% (95%, confidence interval: 12%–16%) under-fives were correctly prescribed antibiotics based on correct final diagnosis. Health care providers from non-Tibu Homa Project supported health facilities, those working in hospitals and inpatient febrile under-fives were independent predictors of prescribing anti-malarial drugs to febrile under-fives with no malaria.

**Conclusions:** The proportion of clinicians prescribing antimalarial medications and over-prescribing antibiotics to malaria negative-tested under-fives in the Lake Zone is high, 11%, and as low as 14% of clinicians prescribed antibiotics correctly based on correct final diagnoses. Training of health care workers, health managers and regular supportive supervision may significantly improve prescription practices among clinicians attending under-fives.

## 1. Introduction

It is estimated that more than 9 million children under the age of five die each year and the risk of dying is more than 10 times among children from developing countries. The reported leading causes of under-five mortality are pneumonia, diarrhoea and several complications for newborns[1]. With a progressive decline of under-five mortality rate in Tanzania from 137 in 2006 to 81 per 1 000 live-birth in 2010, yet the major three reported causes of mortality continue to be malaria (29%), pneumonia (28%) and diarrhoea (15%)[1,2].

In developing countries, febrile illnesses are among the leading morbidities and mortality in children aged below five years[3,4]. For that matter, fever-related illnesses in children are some of the main reasons for most parents and caretakers to seek health care services in health facilities[5,6]. In Tanzania, like in other malaria endemic regions, non-malarial febrile illnesses in children remain the most common clinical symptom associated with bacterial or viral infections[7,8]. The etiology of most fevers, between 50% to 90% is due to acute respiratory infections and between 10% to 15% is due to gastroenteritis (diarrhea)[9].

The World Health Organization and Integrated Management of Childhood Illness guideline direct, among other things, children with fever to be treated for malaria upon laboratory evidence of malaria and guide them how to appropriately manage other malaria negative patients for other causes of fever. However, anti-malaria prescription to malaria with negative test results and those not tested is still practiced in Tanzania despite the universal malaria testing policy. When it comes to non-malarial febrile children, there are always great concerns of poor management by either over-diagnosis

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or over-treatment including wrong treatment[9-12]. Although there are no clear explanations for unexpected management of non-malarial fevers, hypothesized reasons include poor pediatric health care infrastructure, misinterpretation of the treatment algorithms, lack of belief in laboratory results, and lack of sufficient knowledge in management of non-malaria fevers[13]. Furthermore, besides members of the community in Tanzania perceiving fevers to always implying malaria, patient pressure to get antimalarials has also been implicated among health workers[14].

With intensive training about management of fever and non-fever related illnesses by several stakeholders in the Lake Zone, it is not clear if this practice has changed. Therefore, this study was conducted in the Lake Zone of Tanzania to determine prescription practices for non-malarial fever cases among febrile under-fives in the Lake Zone of Tanzania.

## 2. Materials and methods

### 2.1. Study design

This was a comparative cross-sectional hospital-based study. Medical records of children aged at less than five years with fever but negative for malarial were retrieved from the medical records departments. For comparison purpose, we considered under-fives from health facilities supported by Tibu Homa Project and those were not supported by the project.

### 2.2. Study settings

The Lake Zone is situated in the North-West of Tanzania along the Lake Victoria. It comprises of six administrative regions, namely, Geita, Kagera, Mara, Mwanza, Shinyanga and Simiyu. The zone has an estimated total population of 11.8 million (26.3% of the national's population) of which about 11.5% are children below five years[15]. By the time of the study, the zone had a total of 37 districts (an administrative sub-division of a region). For the purpose of this study, the three regions, namely, Kagera, Mwanza and Shinyanga were selected. These regions were supported by Tibu Homa Project. One of the aims of the project was to reduce childhood morbidity and mortality by improving diagnosis and treatment of childhood illnesses in the project area. The under-five mortality rate in the zone was estimated to be 109 per 1 000 live-births[2]. This rate was significantly higher compared to the national average of 81 deaths per 1 000 live births.

### 2.3. Study population

The study included records of children aged less than five years brought to health facilities (hospitals, health centres and dispensaries) by parents or care-givers. The main inclusion criterion was a child reported to have fever, tested for malaria rapid diagnostic test (mRDT) or blood slide for microscopy and the laboratory diagnostic showed that they had no malaria.

### 2.4. Sample size and sampling procedure

We stratified health facilities into either Tibu Homa Project (THP)-supported health facilities or non-THP-supported health facilities. This prior stratification was meant to make comparisons of prescription practices of under-fives between clinicians from the two groups.

In each group, we applied a three-stage selection of health facilities. First, we selected randomly one public and one private district hospital. Second, we selected one public and one private health centre and finally, we selected two public and two private dispensaries. We estimated a minimum sample of 1 080 records of children aged less than five years. This number was split equally between the two groups to make 540 per study group. We allocated 220, 160 and 160 records for the two hospitals, two health centres and four dispensaries respectively in each group.

### 2.5. Process

In two study groups, there was no random selection of records per site. However, to have a common starting point, records were retrieved and reviewed backward from date of our visit until the required sample size per health was achieved. Nevertheless, selection of a record of under-five in the health facility supported by THP, the review did not go to the time before the Tibu Homa Project was initiated in the respective facility.

Registered qualified medical personnel extracted data for each child included in the study to the data compilation sheets. Data included on background information of the child reported symptoms at admission, provincial and differential diagnoses, type of investigations or laboratory requested and their results, final diagnosis and a list of medications prescribed to the child. Age of the child was computed based on the date of birth as it appeared on the medical record otherwise by as reported by parent/caregiver.

### 2.6. Data processing and analysis

An independent reviewer (a pediatrician) assessed if the child was examined correctly, if the child's final diagnosis was correct based on the examination results and whether the medications were correct based on the final diagnosis. Data were entered in the computer software (SPSS) and checked for consistencies. Frequencies were used for descriptive statistics and cross-tabulations to assess associations using *Chi*-square test. Factors with *P* values less than 0.2 were included in the multivariable logistic regression model to assess independent predictors of irrational prescription of antimalarials to febrile under-fives who were tested negative for malaria.

### 2.7. Ethical consideration

Since the study did not involve contact with patients, no institutional review process was requested. But permissions to conduct the study were requested from regional medical officers and district medical officers and health facility in-charges of selected facilities. However, during data collection for purpose of confidentiality, no names or other identifying information of patients were recorded in the data compilation sheets such that there was not any possibility to link the results of the assessment and individual patient. Furthermore, no patient case files assessed were removed from the respective health facilities.

### 2.8. Recruitment and training of research assistants

The four research assistants with medical degrees and at least

two years of experience in a medical related field served as data collectors. There were two supervisors (a study coordinator and a paediatrician). All research assistants were introduced to the objectives and were trained for the study and also received training on ethics. The use of experienced clinicians made it possible to assess the performance of health care providers in the examination, diagnosis and in prescription practices.

## 3. Results

### 3.1. Description of study participants

We retrieved 1 010 (93.5% of the calculated sample size) records of under-fives. Of these, 503 (49.8%) were girls. Their overall mean age was 18.7 (SD = 14.2) months. The majority, 753 (74.6%), were inpatients. Other background characteristics classified by study group were presented in Table 1.

**Table 1**
Distribution of background characteristics of febrile under-fives by study group.

| Characteristics | | THP support* [$n$ = 521 (51.6%)] | No THP support* [$n$ = 489 (48.4%)] | Total number [$n$ = 1 010 (%)] |
|---|---|---|---|---|
| Sample origin | Hospitals | 219 (41.0) | 220 (45.0) | 439 (43.5) |
| | Health centres | 163 (31.3) | 121 (24.7) | 284 (28.1) |
| | Dispensaries | 139 (26.7) | 148 (30.3) | 287 (28.4) |
| Sex of the child | Male | 250 (48.0) | 237 (48.5) | 487 (48.2) |
| | Female | 267 (51.2) | 236 (48.3) | 503 (49.8) |
| | Not indicated | 4 (0.8) | 16 (3.3) | 20 (2.0) |
| Child's age (months) | < 12 | 192 (36.8) | 157 (32.1) | 349 (34.6) |
| | 12–23 | 121 (23.2) | 117 (23.9) | 238 (23.6) |
| | 24–35 | 58 (11.1) | 74 (15.1) | 132 (13.1) |
| | 36–47 | 42 (8.0) | 57 (11.7) | 99 (9.8) |
| | 48–59 | 25 (4.8) | 41 (8.4) | 66 (6.5) |
| | Not exact† | 83 (15.9) | 43 (8.8) | 126 (12.5) |
| Type of admission | Inpatient | 138 (26.5) | 109 (22.3) | 247 (24.5) |
| | Outpatient | 376 (72.2) | 377 (77.1) | 753 (74.6) |
| | Not indicated | 7 (1.3) | 3 (0.6) | 10 (1.0) |

*: Numbers do not add up due to missing information; †: Under-five without exact age.

### 3.2. Reported and recorded symptoms and signs in under-fives

In Table 2, we presented symptoms and signs in under-fives within past two weeks prior to presentation at the health facility. In general, there were more under-fives in health facilities supported by THP as compared to those not supported by THP. Nevertheless, since fever was a criterion for selection for each under-five, other most common symptoms and signs included cough 486 (48.1%), diarrhoea 262 (25.9%) and vomiting 256 (25.3%).

**Table 2**
Reported symptoms and signs within past two weeks in under-fives by study group.

| Symptom and signs | THP support [$n$ = 521 (51.6%)] | No THP support [$n$ = 489 (48.4%)] | Total [$n$ = 1 010 (%)] |
|---|---|---|---|
| Cough | 270 (51.8) | 216 (44.2) | 486 (48.1) |
| Diarrhea | 137 (26.3) | 125 (25.6) | 262 (25.9) |
| Vomiting | 151 (29.0) | 105 (21.5) | 256 (25.3) |
| Difficulty in breathing | 32 (6.1) | 23 (4.7) | 55 (5.4) |
| Body weakness | 15 (2.9) | 33 (6.7) | 48 (4.8) |
| Convulsions | 16 (3.1) | 12 (2.5) | 28 (2.8) |
| Other* | 14 (2.7) | 4 (0.8) | 18 (1.8) |

*: Other included pain when urinating, ear discharge, unable to feed, *etc*.

### 3.3. Recorded clinical diagnosis

In Table 3, we presented major clinical diagnoses in under-fives. These included respiratory tract infections (RTI) [171 (16.9%)], pneumonia [149 (14.8%)] and urinary tract infections (UTI) [103 (10.2%)]. More than twice under-fives were diagnosed provisionally with RTI and UTI at THP supported health facilities than elsewhere.

**Table 3**
Major provisional diagnoses in febrile under-fives presenting at health facilities.

| Provisional diagnosis | THP support [$n$ = 521 (51.6%)] | No THP support [$n$ = 489 (48.4%)] | Total [($n$ = 1 010 (%)] |
|---|---|---|---|
| RTI | 121 (23.2) | 50 (10.2) | 171 (16.9) |
| Pneumonia | 74 (14.2) | 75 (15.3) | 149 (14.8) |
| UTI | 75 (14.4) | 28 (5.7) | 103 (10.2) |
| Anemia | 17 (3.3) | 19 (3.9) | 36 (3.6) |
| Cough or cold | 10 (1.9) | 18 (3.7) | 28 (2.8) |
| Worm infestation | 16 (3.1) | 11 (2.2) | 27 (2.7) |
| Other* | 19 (3.6) | 66 (13.5) | 29 (2.9) |

*: Other included dysentery, typhoid fever, measles, septicemia, malnutrition, meningitis, HIV, *etc*.

### 3.4. Laboratory investigations

All under-fives were tested for malaria either by malaria rapid diagnostic test (mRDT) [584 (57.8%)] or by malaria microscopy (blood smear) [429 (42.5%)]. Also tests included hemoglobin levels [263 (26.0%)], urinalysis [159 (15.8%)] and stool microscopy [134 (13.3%)] (Table 4).

**Table 4**
Major laboratory investigations performed for febrile under-fives by study group.

| Name of investigation/test | THP support [$n$ = 521 (51.6%)] | No THP support [$n$ = 489 (48.4%)] | Total [($n$ = 1 010 (%)] |
|---|---|---|---|
| mRDT | 326 (62.6) | 258 (52.8) | 584 (57.8) |
| Boold smear | 197 (37.8) | 232 (47.4) | 429 (42.5) |
| Hemoglobin | 92 (17.7) | 171 (35.0) | 263 (26.0) |
| Urinalysis | 114 (21.9) | 45 (9.2) | 159 (15.8) |
| Stool microscopy | 90 (17.3) | 44 (9.0) | 134 (13.3) |
| Other* | 8 (1.5) | 10 (2.0) | 18 (1.8) |

*: Other included full blood picture, cerebral spinal fluid, urine culture, HIV, random blood glucose and Widal tests.

### 3.5. Final diagnoses among febrile under-fives

We classified the final diagnoses into either bacterial or non-bacterial infections. There were 778 (77.0%) under-fives diagnosed with at least one bacterial infection. The main bacterial infections were meningitis, typhoid fever, UTI, septicemia, acute otis media, impetigo and tonsillitis. The common non-bacterial final diagnoses were RTI, anaemia, cough or cold, diarrhoea and multiple non-bacterial infections (Table 5).

**Table 5**
Final diagnoses among febrile under-fives.

| Final diagnosis | THP support [$n$ = 521 (51.6%)] | No THP support [$n$ = 489 (48.4%)] | Total [$n$ = 1 010 (%)] |
|---|---|---|---|
| Bacterial | 375 (71.8) | 403 (82.4) | 778 (77.0) |
| Non-bacterial | 146 (28.0) | 86 (17.6) | 232 (22.9) |
| RTI alone | 121 (23.2) | 50 (10.2) | 171 (16.9) |
| Anemia alone | 17 (3.3) | 19 (3.9) | 36 (3.6) |
| Cough or cold alone | 10 (1.9) | 18 (3.7) | 28 (2.8) |
| Diarrhea alone | 1 (0.2) | 0 (0.0) | 1 (0.1) |
| Multiple non-bacterial | 3 (0.6) | 1 (0.2) | 4 (0.4) |

### 3.6. Medications prescribed to febrile under-fives

The majority [515 (50.9%)] of febrile under-fives with no malaria received antibiotics. Although health care providers in non-THP supported health facilities prescribed more antibiotics [53.8%, 95% confidence interval (*CI*): 49.3%–58.3%] as compared to those from THP supported (48.3%, 95% *CI*: 43.9%–52.7%) and the difference was not statistically significant.

Although these under-fives were all negative for malaria, yet 116 (11.5%) were given antimalarial prescriptions (Table 6). Antimalarials prescription behaviors were almost twice, (15.1%, 95% *CI*: 12.1%–18.6%), among health care givers in non-THP supported health facilities as compared to health care givers from THP supported health facilities (8.0%, 95% *CI*: 5.9%–10.7%).

**Table 6**
Categories of medications prescribed to febrile under-fives.

| Categories of medication | THP support [*n* = 521 (51.6%)] | Non-THP support [*n* = 489 (48.4%)] | Total [*n* = 1011 (%)] |
|---|---|---|---|
| Antibiotics | 252 (48.3) | 263 (53.8) | 515 (50.9) |
| Antimalarials | 42 (8.0) | 74 (15.1) | 116 (11.5) |
| Anti-diarrhoea | 75 (14.4) | 43 (8.8) | 118 (11.7) |
| Anti-anaemia | 34 (6.5) | 30 (6.1) | 64 (6.3) |
| Other | 119 (22.8) | 79 (16.2) | 198 (19.6) |

Antibiotics included piriton, phenegan, cotromoxazole, nystatin, metronidazole, gentamycin, chloramphenical, amoxyllin/ampiclox/penicillin V, ceftriaxone, X-pen and procaine penicillin forte. Anti-diarrhoea included Z and anti-anaemia included folic acid, Fe, vitamin and oral rehydration salts.

### 3.7. Clinical performance of health care workers

Reviewers concluded that of all febrile under-fives [240, (23.8%, 95% *CI*: 21.2%–26.5%)] were examined correctly and a correct provisional diagnosis was made but only a quarter of under-fives [259, (25.6%, 95% *CI*: 23.0%–28.5%)] had the final diagnosis correctly made based on examination results. A total of 139 (13.8%, 95% *CI*: 11.7%–16.0%) febrile under-fives received antibiotics prescriptions based on correct final diagnosis. In the three assessment areas, health care providers from THP supported health facilities performed significantly better than their counterparts (Figure 1). However, there were no statistical differences in the three parameters by health facility ownership (public or private) or level of health facility (hospital, health center or dispensary).

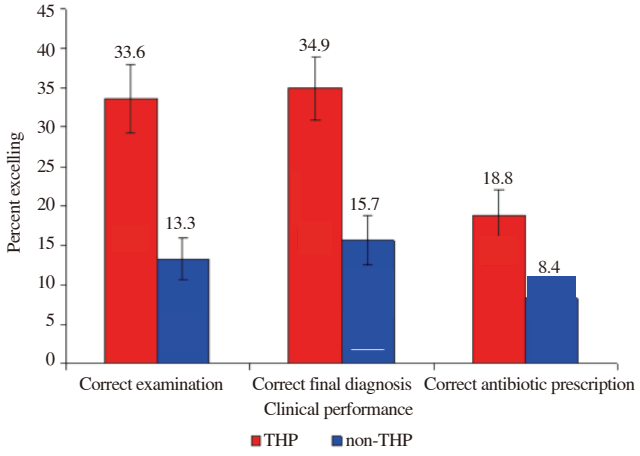


**Figure 1.** Clinical performance of clinicians by study group.

### 3.8. Factors associated with prescription of antimalarials to febrile under-fives without malaria

A total of 116 (11.5%) under-fives with non-malarial fever were given antimalarial prescriptions. In Table 7, we presented factors associated with wrong prescription of anti-malarials. Health care providers from non-THP supported health facilities had significantly elevated odds of more than eight-fold, [odds ratio (OR) = 8.4, 95% *CI*: 3.4%–21.0%], to prescribe anti-malarial drugs to febrile under-fives with no malaria as compared to health care providers supported by the THP.

**Table 7**
Factors associated with prescribing antimalarials to febrile under-fives diagnosed negative for malaria.

| Factors | | Malaria prescription [*n* (%)] | OR (95% *CI*) | |
|---|---|---|---|---|
| | | | Unadjusted | Adjusted |
| Study group | THP | 42 (36.2) | Reference | Reference |
| | Non-THP | 74 (63.8) | 2.0 (1.3–3.0) | 8.4 (3.4–21.0) |
| Region | Kagera | 44 (37.9) | Reference | Reference |
| | Mwanza | 33 (28.4) | 0.9 (0.6–1.5) | 1.1 (0.6–1.8) |
| | Shinyanga | 39 (33.6) | 1.9 (1.2–3.1) | 0.1 (0.05–0.4) |
| Type of health facility | Hospital | 74 (63.8) | 1.7 (1.1–2.6) | 3.8 (1.5–10.1) |
| | Health centre | 11 (9.5) | 0.3 (0.1–0.7) | 0.3 (0.1–0.7) |
| | Dispensary | 31 (26.7) | Reference | Reference |
| Ownership of facility | Public | 61 (52.6) | 1.4 (0.9–2.1) | 0.8 (0.5–1.3) |
| | Private | 55 (47.4) | Reference) | Reference) |
| Admission status | Inpatient | 52 (45.6) | 3.0 (2.0–4.4) | 3.3 (2.0–5.6) |
| | Outpatient | 62 (54.4) | Reference | Reference |

Also, health care providers working at hospitals had significantly increased odds about four-fold [OR = 3.8 (95% *CI*: 1.5–10.1)] to prescribe anti-malarials as compared to health care providers working in the dispensaries. Similarly, the odds of prescribing anti-malarial medications to inpatient febrile under-fives who were negative for malaria were more than three times as compared to outpatient under-fives [OR = 3.3 (95% *CI*: 2.0–5.6)].

## 4. Discussion

In this study, between 25% and 50% of parents/caregivers of febrile under-fives were reported with cough, vomiting and diarrhoea as medical symptoms leading to them to seek medical care. Although the current study involved only febrile under-fives but negative for malaria, a study in Rakai, Uganda that assessed febrile under-fives with malaria admitted in a hospital and health centre, found almost similar prevalence of cough, vomiting and diarrhoea[16]. The majority (80%) of these under-fives were eventually diagnosed with bacterial infections that were associated with these symptoms. Causes of febrile illnesses specifically among under-fives have been extensively studied in some areas of Easter Africa[8,17-19].

Data indicate a high prevalence (above 70%) of bacterial infections among febrile under-fives attending either THP or non-THP supported health facilities. The high prevalence of bacterial infections may be explained partly due to the coexistence of illnesses and due to poor compliance of health care workers to diagnostic/treatment algorithm. While a high prevalence of bacterial infections is associated with prescription of antibiotics, over-prescription of antibiotics has been previously reported mong service providers in health facilities not only in Tanzania but also beyond the region[19-

23]. One hypothesized reason of over-prescription is the difficulty in diagnosing bacteraemia[24]. There are reports indicating decline in the prevalence of malaria in Tanzania[25-29]. Despite these successes, with World Health Organization updated guidelines recommending that all fevers in children test for malaria and malaria treated according to evidence and Tanzania roll out of universal testing since 2012, anti-malarial prescription to patients with negative test results and those not tested are still practiced in Tanzania. There have been challenges for the treatment of febrile illnesses and one being the lack of diagnostic equipment and sometimes where equipment exists mistrust the results among clinicians[12,30-32]. In some previous studies, improved adherence to national guidelines for malaria upon laboratory evidence was associated with increased use of antibiotics in non-malaria negative under-fives management of bacterial infections which was another challenge. Health care providers did not prescribe antibiotics to eligible children, antibiotics being prescribed to those ineligible, inadequate dosage, possibly leading to drug resistance due to irrational prescription practices[23,33].

This study showed that clinicians are still prescribing antimalarial medications to more than 10% of febrile under-fives confirmed negative for malaria using malarial microscopy or mRDT. Prescription of anti-malarial medications to patients tested negative for malaria and sometimes not even tested has been reported earlier in Tanzania[34]. The odds of this practice were elevated in clinicians working in hospitals, among in-patient under-fives and to irrespective of facility ownership (public or private). The low proportion of prescribing antimalarials to febrile under-fives with no malaria found among health care providers in health facilities supported by THP may be a result of improved logistic management systems and training along with supportive supervision from THP to health care providers in the Lake Zone.

The current facility-based study assessed prescription practices for under-five children with fever but confirmed to have no malaria either by a rapid test (mRDT) or microscopy. We used patient files to get clinical records that were available at each of the selected health facilities. Then, we retrieved these records backwards until the estimated sample was attained. The approach of retrieving patients' records has been applied before and was found feasible[35-37]. Nevertheless, incomplete patient information in some health compromises their intended use. But use of medical records of patients does not allow assessing information on treatment or prescription practices on the perspective of health care providers. For that matter, lack of these data limits analysis of factors associated with improper prescription of medications. We also recommend the use of qualitative approach to health care providers to bring up reasons for the observed irrational use of antibiotics and incorrect prescription of antimalarials in the study area. Furthermore, we compared prescription practices of caregivers between those in THP-supported and non-supported health facilities. There is a possibility of having spillover effect from the former to the latter group that we could not control. Therefore, caution should be considered when comparing the two groups.

In conclusion, the proportion of clinicians prescribing antimalarial medications and over-prescribing antibiotics to malaria negative-tested under-fives is still practiced in the Lake Zone. A low percentage of clinicians prescribed antibiotics correctly based on correct final diagnoses. These two phenomena are lower among health care givers in health facilities supported by THP than in other health facilities. Assessment of correct examination of under-fives, correct final diagnosis and proper prescription of antibiotics based on final diagnosis of bacterial infections also suggests non-compliance to prescription guidelines.

## Conflict of interest statement

We declare that we have no conflict of interest.

## Acknowledgments

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