Common childhood illnesses: 
a cross-sectional study of commodity stocking 
patterns and management knowledge 
among patent and proprietary medicine 
vendors in Nigeria

Selema Margaret Akuiyibo, Jennifer Anyanti, Babatunde Abiodun Amoo*, Dennis Aizobu and Omokhudu Idogho

Abstract

Background: The trio of commonest illnesses and causes mortality among children under five (Malaria, Pneumonia and Diarrhea) are easily treatable through timely exposure to cost effective interventions at the community level. Patent and proprietary medicine vendors (PPMVs) are a leading source of care for illnesses among under-five children in Nigeria. This study was designed to explore child health services offering, particularly commodity stocking patterns and case management knowledge for common childhood illnesses among PPMVs in Ebonyi and Kaduna States.

Methods: A descriptive cross-sectional study was conducted among PPMVs in four local government areas across Ebonyi and Kaduna States. Data was collected using semi-structured interviewer-administered questionnaires. Information was obtained on medicine and supplies, knowledge of common childhood illnesses management and referral practices.

Results: A total of 374 PPMVs were interviewed; the mean age was 33.7 ± 9.8 years. Among the 132 health trained respondents, 59.0% offer treatment services for sick children while 83.5% of the non-health trained respondents offer the same service. At least, 88.0% of the respondents keep stock ACTs, Amoxycilin DT, ORS and Zinc. About 38.5% reported stock-out of ACTs in the month preceding the study, 55.1% reported stock out lasting only 0 to 6 days. Only 83 (22.2%) of respondents knew the correct diagnosis of fast breathing among children aged 2 to less than 12 months old. Education and health training background were associated with good knowledge of common childhood illnesses management ($X^2 = 44.88, p < 0.001; X^2 = 27.14, p < 0.001$).

Conclusion: The relative constant availability of medicines and commodities for managing childhood illnesses positions PPMVs as a preferred source of care for these illnesses. There is a need to complement steady stock availability with provision of quality services by exposing PPMVs to trainings on integrated community case management of childhood illnesses and implementation of robust supervision mechanism to monitor them.

Keywords: Child Health, PPMV, Common Childhood Illnesses Management, Under Five, Malaria

*Correspondence: amoobabatundey@gmail.com
Society for Family Health, Abuja, Nigeria
Background
Malaria, Pneumonia and Diarrhea are among the leading causes of mortality among the under-five population across the globe [1]. In 2018, these three illnesses accounted for almost three out of every ten deaths among under-five in West Africa [1]. About 70% of deaths due to malaria in 2018 were among children under five while almost 1.7 billion cases of childhood diarrhea and 1,400 cases of pneumonia per 100,000 children occur every year; the trio claims the lives of over 1.5 million children every year [2]. According to the 2018 Nigeria demographic and health survey (NDHS), the under-five mortality rate in Nigeria is 132 per 1,000 live births; an increase from 128 per 1,000 live births in 2013 [3]. More than 75% of these deaths were as a result of malaria, pneumonia and diarrhea [4]. Similarly, malnutrition has been associated with increased risk of mortality among children and with an increased risk of death due to diarrhea and pneumonia [5].

Despite their huge burden, these illnesses are preventable through access to lifesaving treatments such as adequate nutrition, vaccination, breastfeeding and are treatable using cost effective essential medicines—pneumonia with effective antibiotics (dispensible amoxicillin tablets), malaria with an artemisinin-based combination therapy (ACT) and diarrhea with oral rehydration salts (ORS) and zinc [6, 7]. Inadequate access, poor knowledge, and poor care seeking behaviour for these life-saving interventions may be responsible for the high burden of these illnesses in developing countries. Several developing countries including Nigeria, have adopted an equity-focused strategy of the World Health Organisation (WHO) referred to as the integrated community case management of childhood illnesses (iCCM).

The iCCM strategy is aimed at improving access to lifesaving treatments for children as it can be readily delivered at the community level through community health workers. iCCM complements and extends the reach of public health services by providing timely and effective treatment of malaria, pneumonia and diarrhea to populations with limited access to facility-based health care providers, and especially to children under 5. The strategy has proven to be effective in increasing access to care in hard-to-reach rural communities in different African countries [8, 9]. Interventions in African countries have reported its effectiveness in reducing under five mortality by as high as 15% [8]. Through the WHO supported iCCM intervention in Abia and Niger States of Nigeria, community health workers provided lifesaving treatments which contributed to 70% and 80% child lives respectively saved over the course of the intervention in the two states [8, 10].

Patent and proprietary medicine vendors (PPMVs) are gradually becoming an integral part of the Nigerian health system especially for their role in the delivery of primary healthcare services and products. This is due to their presence even in hard-to-reach areas, long opening hours and consistency of service availability unlike government owned health facilities [11]. Although, there are concerns about the quality of services being provided by PPMVs [12, 13], they still remain a major source of healthcare services in urban and rural settings in Nigeria. According to 2018 NDHS, PPMVs were the most sought-after source of advice or treatment for fever, diarrhea and acute respiratory infections (ARIs) for under five children compared to other sources including private and public hospitals, community health workers [3]. Also, PPMVs sell and are a major source of orthodox medicines for acute conditions including malaria, diarrhea and pneumonia [7, 12].

Research has shown that several PPMVs in Nigeria have formal and health or medical training which are comparable to community health workers, who have been used to scale up iCCM interventions [7]. The “Delivering Healthcare to all Children” (Del2All) project is a one-year project of Society for Family Health (SFH) which is targeted at improving PPMVs’ capacity to manage uncomplicated cases of common childhood illnesses (pneumonia, malaria & diarrhea) and to improve community knowledge, care seeking behavior and uptake of services for these illnesses in Ebonyi and Kaduna States. This study was designed as part of the evaluation plan of the project, to explore child health services offering, commodity stocking patterns and case management knowledge for childhood illnesses (Malaria, Pneumonia and Diarrhea among under-five children) among PPMVs in selected local government areas (LGAs) in Ebonyi and Kaduna States. Findings from this study will assist stakeholders in the health sector to better understand the roles PPMVs have in the provision of child health services, identify gaps, and will provide an evidence-base for interventions targeted at improving child health in communities through PPMVs.

Methods
Study area
Ebonyi and Kaduna States are respectively in the southern and northern regions of Nigeria. Kaduna State covers a land mass of about 46,000 km² which is about nine times the size of Ebonyi State. Like other Nigerian states, both Ebonyi and Kaduna States are divided into smaller administrative units referred to as Local government areas (LGAs). Although Kaduna State has 23 LGAs, Ebonyi State has only 13 LGAs. According to the Nigeria Population Commission, Ebonyi State had a population
of about 5.6 million residents compared to 8.3 m residents in Kano State in 2016. Majority of the residents in the two states are into agriculture.

**Operational definition**

**Patent and Proprietary Medicine Vendors (PPMVs)—** According to the Pharmacists Council of Nigeria (PCN), PPMVs are individuals without a formal education or training in Pharmacy who sell patent and other medicine products for profit and in retail quantities [14, 15]. Formal training in a health or medical field is not a requirement for licensing as a PPMV in Nigeria. In most cases, completion of apprenticeship under the tutelage of a more experienced or a licensed pharmacist is sufficient for registration and licensure by PCN [13]; the official body responsible for PPMVs licensing and regulation of their activities. They are among the primary providers of healthcare in Nigeria.

**Integrated Community Case Management of Childhood Illnesses (iCCM)—** is a comprehensive equity-focused strategy to provide timely and effective treatment of malaria, pneumonia, and diarrhea among children under 5, especially in underserved areas.

**Common Childhood illnesses—** These include cases of malaria, pneumonia, and diarrheas among children under the age of five years.

**Diagnosis—** Among children presenting with fever, diagnosis of malaria is done using a Rapid Diagnostic Test for malaria (mRDT) while diagnosis of diarrhea among children (2 – 59 months) is done following least three loose stools within 24 h. Fast breathing pneumonia among children with cough, difficult or rapid breathing is assessed by counting their respiratory rate with a respiratory rate counting timer. The WHO age-specific cut-off points for fast breathing pneumonia is ≥50 breaths per minute for children aged between 2 and 12 months and ≥40 breaths per minute for children aged between 12 months and 5 years.

**Treatment/Management—** Cases aged 6 to 59 months with a positive mRDT are to be treated with Artemisinin Combination Therapy (ACT) while fast breathing pneumonia is treated with amoxicillin dispersible tablets (Amoxicillin DT). Diarrhea cases among 2 – 59 months olds are treated with ORS and Zinc combination. However, recommended management practices in iCCM include referral for clinical management following treatment failures or for severe/complicated cases of the common childhood illnesses.

**Study design and sampling procedure**

This study was conducted by the Del2All project of Society for Family Health. Del2All is a one-year child health focused intervention being implemented in two rural LGAs in Ebonyi and Kaduna States, respectively. On the project, selected registered and licensed PPMVs in the project locations were trained on iCCM, provided with seed product stock and equipment for the management of common childhood illnesses, and client data management. In addition, the project engaged and trained Interpersonal Communication Agents (IPCAs) who work in the catchment areas of the trained PPMVs to improve mothers/caregivers of under 5’s knowledge of common childhood illnesses. These individuals (IPCAs) are funded by the project to carry out community advocacy and sensitization on iCCM in the project locations and are different from the government-employed Community Oriented Resource Persons (CORPs).

Prior to the implementation of Del2All project interventions, this descriptive cross-sectional study was conducted among all the participating PPMVs of the project. A structured questionnaire was used to collect information on the PPMVs’ characteristics, their knowledge of case management and their commodity stocking practices for malaria, pneumonia and diarrhea among under-five children in their locality.

The selection of the Ebonyi and Kaduna States was purposively done by the Del2All project team to ensure geographical representation of the two regions of Nigeria and to ensure inclusion of the States with significant contribution to the child health mortality in both regions [16]. The project interventions are in a total of 4 LGAs (two in each State). Selection of LGAs was done by the project team in collaboration with the respective State Ministries of Health, who prioritized; i.) hard-to-reach LGAs, (ii) LGAs with existing structures for iCCM intervention and (iii) LGAs with high child mortality rates. The project team further selected all the PPMVs across the LGAs who were registered with and licensed by the Pharmacists Council of Nigeria to dispense patent medicines. The owner or operator (depending on which of them is responsible for the day-to-day running) of each selected PPMV outlet was included in this study.

**Inclusion criteria**

All participating PPMVs in the Del2All project from whom an informed consent was obtained and who were willing to participate in the study. The project works with a total of 400 PPPMVs across the two project States.

**Data management and analysis**

Data was collected using semi-structured interviewer-administered questionnaires. The questionnaires were designed in English language for ease of administration for literate respondents and were interpreted to the respondent’s indigenous language and completed with the aid of the interviewer for those without formal
education. The questionnaire was divided into five broad sections which include: Personal Information of the respondent, Medicine and Supplies, Knowledge of iCCM, Promotion of key family practices, treatment and referral practices. Items in the questionnaire were adapted from demographic and health surveys [16] and other studies conducted in similar settings including the UNICEF/LSTM Lot Quality Assurance Survey Questionnaire for Community Health Workers.

Data was analysed using SPSS version 20.0 and the results were presented in tables and charts. Continuous variables were summarized as means ± standard deviations, range and proportions while discrete variables were summarized as frequencies and percentages. Chi-square test was used to investigate associations between knowledge (grouped), appropriate management of the three diseases and socio-demographic characteristics of respondents. P-values less than 0.05 were regarded as statistically significant. The management domains for common childhood illnesses were classified as Diagnosis and treatment. Responses that were in and not in consonance with the WHO recommended iCCM guideline for each illness were classified as “Correct” and “Incorrect” respectively. A score of “1” was assigned to each correct response while a “0” score value was assigned to incorrect response. The scores were summed up and were grouped as “Good” and “Poor” respectively for aggregate management knowledge scores that were at least fifty percent and less than fifty percent of the total obtainable scores.

Ethical considerations
Ethical approval was obtained from the Health Research and Ethics Committee, Nigerian Institute for Medical Research. Participation was voluntary after each respondent had received detailed information on the purpose of the study followed by a written informed consent before questionnaires were administered.

Results
Characteristics of patents and proprietary medicine vendors
In this study, a total of 374 patent and proprietary medicine vendors (PPMVs) were interviewed across Ebonyi and Kaduna States; an equal proportion was selected in each State (187 PPMVs per State). The mean age of the respondents was 33.7 ± 9.8 years. A total of 153 (40.9%) of them were between 21 and 30 years of age while only 5.1% were not older than 20 years. Two hundred and twenty (58.8%) respondents were males while the remaining 41.2% were females. Only three (0.8%) of the respondents had no formal education, 3.7% attained primary education, 42.5% attained secondary education and 52.9% attained tertiary education. Other characteristics of the respondents such as health training background (formal pharmaceutical education or training in clinical or public health irrespective of duration), years of practice as medicine vendor and their designation are presented in Table 1.

Child health service offering
The respondents offer child health services which included assessment and treatment of sick children, referral of severe/complicated cases, promotion of key family practices (such as exclusive and complementary breastfeeding, good hygiene, immunization, use of mosquito nets, etc.), home-visits for mothers & newborns. Service offering was categorised by health training status of the respondents as shown in Fig. 1. Health trained PPMVs included PPMVs who had a post-secondary school education in a health or medical related field while the non-health trained PPMVs either had no formal education or no post-secondary school education in a health or medical related field. Among the 132 health trained respondents, 59.0% of them offered treatment

Table 1 Background Characteristics of Respondents

| Variables                  | Frequency | Percentage (%) |
|----------------------------|-----------|----------------|
| **Age (Years)**            |           |                |
| 20 & Below                 | 19        | 5.1            |
| 21 – 30                    | 153       | 40.9           |
| 31 – 40                    | 122       | 32.6           |
| 41 – 50                    | 54        | 14.4           |
| 51 & Above                 | 26        | 7.0            |
| **Gender**                 |           |                |
| Male                       | 220       | 58.8           |
| Female                     | 154       | 41.2           |
| **State of Residence**     |           |                |
| Ebonyi                     | 187       | 50.0           |
| Kaduna                     | 187       | 50.0           |
| **Highest level of Education** |          |                |
| None                       | 3         | 0.8            |
| Primary                    | 14        | 3.7            |
| Secondary                  | 159       | 42.5           |
| Tertiary                   | 198       | 52.9           |
| **Health Training Background** |        |                |
| Yes                        | 144       | 38.5           |
| No                         | 230       | 61.5           |
| **Years of Practice**      |           |                |
| 1 – 9 years                | 242       | 64.7           |
| ≥ 10 years                 | 132       | 35.3           |
| **Designation**            |           |                |
| Apprentice                 | 40        | 10.5           |
| Employee                   | 29        | 7.6            |
| Outlet Owner               | 312       | 81.9           |
services for sick children, while 83.5% of the non-health trained respondents offered the same service. Sick children assessment service was offered by 59.0% and 46.1% of the health trained and non-health trained respondents respectively as shown in Fig. 1 below.

**Commodity stocking pattern for childhood illnesses**

Majority of the respondents stock drugs for the first line management of malaria (ACTs), diarrhea (Amoxycilin DT) and fast breathing/pneumonia (ORS and Zinc) among children under five. At least, 88.0% of the respondents keep stock each of ACTs, Amoxycilin DT, ORS and Zinc. Only 10.7% of the respondents had a respiratory timer in their outlet while 78.2% of providers had thermometers and 31.0% of them stock RDT kits in their store. In total, 57.2% of the respondents had stock out of at least one of the drugs for the management of common childhood illnesses in their store. Table 3 below shows the breakdown of commodity stock-out in the last month prior to this study by drug type.

**Duration of commodity stock-out**

The most recent (last month) stock-out of drugs for the treatment of childhood illnesses as stated by the respondents ranged from 0 – 6 days, 1 – 4 weeks and >4 weeks. The proportions reported in Fig. 2 below were based on the number of respondents who reported stock-out of each commodity in the last month preceding this study as earlier reported in Table 2. Among the 144 respondents who reported stock-out of ACTs in the last month prior to the study, 55.1% of them reported 0 to 6 days of ACTs stock out while 53.8%, 66.3% and 60.7% respectively experienced stock-outs of Amoxycilin DT, ORS and Zinc which lasted for the same period (0 to 6 days) in the month preceding the study.

**Knowledge of common childhood illnesses management**

Knowledge of common childhood illnesses management were grouped as correct or incorrect. Eighty-three (22.2%) of respondents stated the correct breath counts per minute for the diagnosis of fast breathing among children aged 2 to less than 12 months old while 21.4% stated the correct breath counts per minute for older children between 1 to 5 years old. Correct diagnosis procedure for Malaria, Diarrhea and SAM among under-five children was known by 49.5%, 89.8% and 23.5% of the respondents, respectively. The knowledge of appropriate treatment (including medication type, dosage, and duration of treatment) for these common childhood illnesses observed among the respondents is presented in Table 3 below.

The knowledge of common childhood illnesses management was categorized as “Good” and “Poor” and was compared across the respondents’ characteristics as shown in Table 4. Cumulatively, 26.2% of the respondents had a good knowledge of common childhood illnesses management while the rest, 73.8% had poor knowledge of common childhood illnesses management. Only 10.5% of the respondents who were not older than 20 years had a good knowledge of the management of common childhood illnesses while as high as 34.2% of those aged 31 to 40 years had a good knowledge of childhood illnesses management. Twenty (10.7%) of the Ebonyi respondents demonstrated good knowledge of childhood
illnesses management compared to 41.7% of the Kaduna respondents ($X^2 = 46.52, p < 0.001$). Eighty (40.4%) of the respondents with tertiary education compared to 9.4% and 14.3% of those with secondary and primary education levels respectively had good level of childhood illnesses management ($X^2 = 44.88, p < 0.001$). The respondents with health training background had better knowledge of common childhood illnesses management ($X^2 = 27.14, p < 0.001$).

Table 2  Commodity Stocking Pattern for Childhood Illnesses among PPMVs

| Items (N=374) | Frequency | Percentage |
|---------------|-----------|------------|
| **Availability of Drugs for treatment of childhood illnesses** | | |
| ACTs | 345 | 92.2% |
| Amoxycilin DT | 329 | 88.0% |
| ORS | 358 | 95.7% |
| Paracetamol | 353 | 94.4% |
| Zinc | 331 | 88.5% |
| **Availability of Equipment for childhood illnesses management** | | |
| Thermometer | 285 | 76.2% |
| Mid-upper arm circumference (MUAC) tape | 41 | 11.0% |
| Rapid Diagnostic Test (RDT) kits | 116 | 31.0% |
| Respiratory Timer | 40 | 10.7% |
| **Commodity Stock-Out in the last month** | | |
| ACTs | 144 | 38.5% |
| Amoxycilin DT | 88 | 23.5% |
| ORS | 101 | 27.0% |
| Paracetamol | 92 | 24.6% |
| Zinc | 103 | 27.5% |

Knowledge of danger/referral signs in childhood illnesses management

Among the respondents, convulsion was stated as one of the referral signs in the management of childhood illnesses by 73.3% of the respondents. Only 20.6% knew that a red MUAC tape reading is a referral sign for severe acute malnutrition treatment, 53.2% knew that vomiting of every food/drink given to child is a referral sign for diarrhea. About a quarter, 40.4% and 40.9% of the
respondents knew that unusual sleepiness or unconsciousness and inability to feed or drink are referral signs for clinical management of common illnesses among under five children Fig. 3 shows other referral signs known by the respondents.

**Discussion**

In this study, we examined the knowledge of the community case management and commodity stocking practices for the diagnosis and treatment of malaria, pneumonia, and diarrhea among PPMVs in Ebonyi and Kaduna States of Nigeria. Our results showed that only about four out of every ten PPMVs had a form of health training background. In spite of this finding, it was observed that the respondents not only dispense drugs for illnesses among children, but they also offer other child health services including treatment of sick children, referral of severe/complicated cases, assessment of sick children among others. PPMVs outlets have been identified as the first point of contact for health services among most Nigerians [12, 16]. Notably, it was observed in this study that a significant proportion of the respondents with no formal health training also offer other child health services such as assessment and subsequent treatment of sick children, home-visit for infants and newborns, promotion of key family practices and referral for severe/complicated cases of childhood illnesses. Thus, the risk of wrong diagnosis is higher with this group as their knowledge of such services is questionable. Thus, there is a need to expand access to quality iCCM for children under five through PPMVs in Nigeria by exposing them to trainings on iCCM.

Generally, most of our respondents stock the first line drugs used in the treatment of malaria, pneumonia and diarrhea among children under five. A similar finding

**Table 3** Knowledge of Common Childhood Illnesses Management among PPMVs

| Management Domains                          | Correct (%) | Incorrect (%) |
|---------------------------------------------|-------------|---------------|
| **Diagnosis**                               |             |               |
| Fast breathing (Pneumonia) – 2 to < 12 months old | 83 (22.2)  | 291 (77.8)    |
| Fast breathing (Pneumonia) – 12 to 60 months old | 80 (21.4)  | 294 (78.6)    |
| Malaria (under five)                        | 186 (49.5)  | 188 (50.5)    |
| Diarrhea—(under five)                       | 336 (89.8)  | 38 (10.2)     |
| Severe Acute Malnutrition (SAM)             | 88 (23.5)   | 286 (76.5)    |
| **Treatment**                               |             |               |
| Fast breathing (Pneumonia) – 2 to < 12 months old | 31 (8.3)   | 343 (91.7)    |
| Fast breathing (Pneumonia) – 12 to 60 months old | 2 (0.5)    | 372 (99.5)    |
| Malaria – 2 to 11 months old                | 112 (29.9)  | 262 (70.1)    |
| Malaria – 12 to 59 months old               | 134 (35.8)  | 240 (64.2)    |
| Diarrhea—(under five)                       | 226 (60.4)  | 148 (39.6)    |

**Table 4** Relationship between PPMVs Characteristics & Knowledge of Common Childhood Illnesses Management

| Variables (N = 374)                      | Good (%) | Poor (%) | X²    | P- Value |
|-----------------------------------------|----------|----------|-------|----------|
| Age (Years)                             |          |          | 9.80  | 0.044*   |
| 20 & Below                              | 2 (10.5) | 17 (89.5)|       |          |
| 21 – 30                                 | 31 (20.3)| 122 (79.7)|      |          |
| 31 – 40                                 | 41 (34.2)| 79 (65.8)|       |          |
| 41 – 50                                 | 16 (30.2)| 37 (69.8)|       |          |
| 51 & Above                              | 8 (30.8) | 18 (69.2)|       |          |
| Gender                                  |          |          | 2.28  | 0.131    |
| Male                                    | 51 (23.5)| 166 (76.5)|      |          |
| Female                                  | 47 (30.5)| 107 (69.5)|      |          |
| State of Residence                      |          |          | 46.52 | < 0.001* |
| Ebonyi                                  | 20 (10.7)| 167 (89.3)|      |          |
| Kaduna                                  | 78 (41.7)| 109 (58.3)|      |          |
| Highest level of Education              |          |          | 44.88 | < 0.001* |
| None                                    | 1 (33.3) | 2 (66.7) |       |          |
| Primary                                 | 2 (14.3) | 12 (85.7)|       |          |
| Secondary                               | 15 (9.4) | 114 (90.6)|      |          |
| Tertiary                                | 80 (40.4)| 118 (59.6)|      |          |
| Health Training Background              |          |          | 27.14 | < 0.001* |
| Yes                                     | 59 (41.3)| 84 (58.7)|       |          |
| No                                      | 39 (16.9)| 192 (83.1)|      |          |
| Years of Practice                       |          |          | 2.58  | 0.108    |
| 1 – 9 years                             | 53 (24.0)| 168 (76.0)|      |          |
| ≥ 10 years                              | 42 (31.8)| 90 (68.2)|       |          |
| Designation                             |          |          | 5.62  | 0.060    |
| Apprentice                              | 87 (28.3)| 220 (71.7)|      |          |
| Employee                                | 4 (10.5) | 34 (89.5)|       |          |
| Outlet Owner                            | 7 (24.1) | 22 (75.9)|       |          |
was made in a study among PPMVs in other Nigerian States where a significant proportion of the respondents also stock these drugs in their shops [7]. On the other hand, the diagnostic equipment for these illnesses, except thermometer for fever, were observed to be available among only a few of the respondents. Evidence has shown that the optimal diagnosis of malaria and pneumonia in children is difficult in the absence of diagnostic equipment, as is expected [17]. Our finding suggests that diagnosis for malaria and fast breathing pneumonia are most likely done without appropriate diagnostic equipment prior to the commencement of treatment among majority of the PPMVs in our study sample. Consequently, this may have serious implications for malaria and pneumonia treatment such as over-diagnosis of possible pneumonia cases as malaria, exposure to unnecessary medication, treatment failures, and consequent poor health outcomes [18, 19].

One of the main components of effective health service delivery is the constant availability of essential medical commodities which includes drugs and equipment (WHO, 2004). Poor quality of care and health service delivery are sometimes attributable to shortage of medical commodities. Although, our respondents reported that they do experience stock-out of ACTs, Amoxicillin DT, ORS and Zinc, in most cases, these stock-out last about a week or sometimes, almost a month. The observed relative stock outs of drug supplies for the treatment of childhood illnesses among PPMV outlets in this study compares favourably to most affordable government-owned health facilities as reported in a survey among Nigerian hospitals [20]. This is because as majority of the PPMVs in this study who experienced stock out in the month preceding the study claimed that the stockout lasted less than a week. Non-availability of medicines in public hospitals among other barriers, affects the ability of patients to seek care and influences choices of place of care with preference for PPMVs among Nigerians [21, 22].

A major challenge in achieving improved outcomes in the management of any illness is the lack of proper clinical management knowledge among service providers. Although, PPMVs do not have a formal training in the management of childhood illnesses, they provide this service [7, 13]. In this study, an alarming proportion of the respondents were unaware of the correct diagnostic criteria for fast breathing pneumonia, malaria and severe acute malnutrition among children under five. Even fewer proportion knew either or both the correct or appropriate medication prescription for these conditions. This is in consonance with findings among community health workers in Uganda [23, 24] and PPMVs in Nigeria [7]. Studies have shown that community management of pneumonia is difficult when compared to malaria [23, 25]. Similarly, a higher proportion of our respondents had incorrect knowledge of pneumonia management (diagnosis and treatment) compared to other illnesses. This is indicative of a huge knowledge gap among PPMVs in pneumonia, malaria and SAM management among under 5 s that can be addressed through exposure to iCCM trainings.

We observed a significant relationship between age, level of education, state, health training background and knowledge of common childhood illnesses management. This is similar to the findings in study by Treleaven et al. (2015) where education and health training were found to the significantly associated with knowledge of childhood illnesses management. Also, more than half of the
outcomes. Among PPMVs, thereby contributing to poor treatment procedures for the common illnesses among children. However, poor knowledge of appropriate diagnostic and referral signs among cases with severe/complicated childhood illnesses suggests that a significant proportion of PPMVs might continue to manage such cases even when there are no observable improvements; this poses great risks to the life of such children.

**Study limitations**
There are a few limitations to note about this study. First, the study participants included only PPMVs who were registered and licensed by the Pharmacists Council of Nigeria. Therefore, our findings may not be representative of all PPMVs in Nigeria especially those who are not licensed by PCN who make up over 90% of PPMVs [11]. Second, we did not assess the quality (potency) and efficacy of the PPMVs’ stock. This could be investigated by subsequent research on a related subject matter. Despite these limitations, we believe that this study provides an overview of commodity stocking patterns and management practices for common childhood illnesses among PPMVs in the study areas, from which inferences can be drawn for programming and intervention on iCCM among PPMVs at state, regional and national levels.

**Conclusions**
In Nigeria, PPMVs are a major source of healthcare; they offer a range of child health services irrespective of their exposure to or background in health training. Their relative accessibility, affordability of health services and constant availability of medicines and commodities for managing childhood illnesses in their stores, compared to government and other private health facilities position them as a preferred source of care for these illnesses. Studies have shown that PPMVs, when exposed to adequate training, may be a reliable source of care for uncomplicated common childhood illnesses [7, 10]. However, poor knowledge of appropriate diagnostic and treatment procedures for the common illnesses among under five children and poor referral practices exists among PPMVs, thereby contributing to poor treatment outcomes.

This study uncovered the need to leverage on the steady stock availability of child health commodities at PPMV shops for provision of quality services. This can be achieved through exposure of PPMVs to trainings on iCCM and deployment of robust supervision mechanism by licensing agencies to monitor and supervise their activities. We observed that level of education and age of PPMVs play a major role in their knowledge of common childhood illnesses management. Thus, in designing training curriculum on capacity building for PPMVs in this case, on iCCM specific consideration should be given to their different background profiles.

**Abbreviations**
ACT: Atermisinin-based Combination Therapy; CORPs: Community Oriented Resource Persons; DEL2ALL: Delivering Healthcare to all Children project; iCCM: Integrated Community Case Management of Childhood Illnesses; LGA: Local Government Area; MUAC: Mid-upper Arm Circumference; ORS: Oral Rehydration Salts; PCN: Pharmacists Council of Nigeria; PPMV: Patent and proprietary medicine vendors; RDT: Rapid Diagnostic Test.

**Acknowledgements**
The authors would like to acknowledge all the participating PPMVs and residents in the study areas who contributed to the success of this study.

**Authors’ contributions**
SMA, JA and OI conceived the study. SA, BAA and DA initiated the study protocol, review of the final manuscript. All authors read and approved the final manuscript.

**Declarations**
The authors declare no competing interests.

**Ethics approval and consent to participate**
The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Nigerian Institute of Medical Research (NIMR) Institutional Review Board (Project No: IRB/20/01, Date: 16th March 2020). Informed consent was obtained from all the respondents involved in the study.

**Consent for Publication**
All the participants have given consent for publication.

**Competing Interests**
The authors declare no competing interests.

**Availability of data and materials**
The dataset used and/or analysed for this study can be obtained by contacting the corresponding author. Access to anonymised data may be granted following review.

**Funding**
This study was fully funded by the authors’ affiliated organisation.

**References**
1. Sanyang Y. Prevalence of under-five years of age mortality by infectious diseases in West African region. Int J Africa Nurs Sci. 2019;11:100175. https://doi.org/10.1016/j.ijans.2019.100175.
2. UNICEF. Childhood diseases. Available from: https://www.unicef.org/health/childhood-diseases. Accessed 27 Sept 2021.
3. National Population Commission (NPC) [Nigeria] and ICF. Nigeria Demographic and Health Survey 2018 Key Indicators Report. Abuja, Nigeria, and Rockville, Maryland, USA: NPC and ICF. 2019. Available from: https://ngrepoarchive.org/ng8443/spur?bistream/123456/789/3145/1/NDHS%20202018.pdf.
4. Adewemimo A, Kalter HD, Perin J, Koffi AK, Quinley J, Black RE. Direct estimates of case-specific mortality fractions and rates of under-five deaths in the northern and southern regions of Nigeria by verbal autopsy interview. PLoS One. 2017;12(5):e0178129. https://doi.org/10.1371/journal.pone.0178129 (Published online).

5. Black RE, Allen LH, Bhutta ZA, et al. Maternal and child undernutrition: global and regional exposures and health consequences. Lancet. 2008;371(9608):243–60. https://doi.org/10.1016/S0140-6736(07)61690-0 (Published online).

6. Kahabuka C, V kale G, Hinderaker SG. Factors associated with severe disease from malaria, pneumonia and diarrhea among children in rural Tanzania—A hospital-based cross-sectional study. BMC Infect. 2012;12:219. https://doi.org/10.1186/1471-2334-12-219 (Published online).

7. Treleaven E, Liu J, Prach LW, Isiguzo C. Management of paediatric illnesses by patent and proprietary medicine vendors in Nigeria. Malari J. 2015;14:232. https://doi.org/10.1186/s12936-015-0747-7 (Published online).

8. Oresanya O, Counihan H, Ndaliman I, et al. Effect of community-based intervention on improving access to health care for sick under-five children in hard-to-reach communities in Nigeria State, Nigeria. J Glob Health. 2019;9(1):010080. https://doi.org/10.7189/JGHO.09.010080 (Published online).

9. Prosnitz D, Herrera S, Davis LM, Zalisk K, Yourkavitch J. Evidence of impact: ICMC as a strategy to save lives of children under five. J Glob Health. 2019;9(1):010801. https://doi.org/10.7189/JGHO.09.010801 (Published online).

10. Liu J, Prach LM, Treleaven E, et al. The role of drug vendors in improving basic health-care services in Nigeria. Bull World Health Or gan. 2016;94(4):267–75. https://doi.org/10.2471/blt.15.154666 (Published online).

11. Oyeyemi AS, Oladepo O, Adeyemi AO, Titiloye MA, Burnett SM, Apera I. The potential role of patent and proprietary medicine vendors’ associations in improving the quality of services in Nigeria’s drug shops. BMC Health Serv Res. 2020;20(1):567. https://doi.org/10.1186/s12913-020-05379-z (Published online).

12. Isiguzo C, Herrera S, Ufere J, et al. Improving access to appropriate case management for common childhood illnesses in hard-to-reach areas of Abia State, Nigeria. J Glob Heal Reports. 2019;3:e2019030. https://doi.org/10.9992/jogh.3.e2019030 (Published online).

13. Oyeyemi AS, Oladepo O, Adeyemi AO, Titiloye MA, Burnett SM, Apera I. The potential role of patent and proprietary medicine vendors’ associations in improving the quality of services in Nigeria’s drug shops. BMC Health Serv Res. 2020;20(1):567. https://doi.org/10.1186/s12913-020-05379-z (Published online).

14. Liu J, Prach LM, Treleaven E, et al. The role of drug vendors in improving basic health-care services in Nigeria. Bull World Health Organ. 2016;94(4):267–75. https://doi.org/10.2471/blt.15.154666 (Published online).

15. Oyeyemi AS, Oladepo O, Adeyemi AO, Titiloye MA, Burnett SM, Apera I. The potential role of patent and proprietary medicine vendors’ associations in improving the quality of services in Nigeria’s drug shops. BMC Health Serv Res. 2020;20(1):567. https://doi.org/10.1186/s12913-020-05379-z (Published online).

16. National Population Commission (NPC) [Nigeria], ICF. Nigeria Demographic Health Survey 2018. Maryland: DHS Progri KF Rockville, 2019. Published online.

17. Yebboh-Antwi K, Pilingana P, Macleod WB, et al. Community case management of fever due to malaria and pneumococcal pneumonia in under five in zambia: A cluster randomized controlled trial. PLoS Med. 2010;7(9):e1000340. https://doi.org/10.1371/journal.pmed.1000340 (Published online).

18. Reyburn H, Mbata R, Drakeley C, et al. Overdiagnosis of malaria in patients with severe febrile illness in Tanzania: A prospective study. Br Med J. 2004;329(7476):1212. https://doi.org/10.1136/bmj.38251.685229. SS (Published online).

19. Amexo M, Tolhurst R, Banih Sh, Bates I. Malaria misdiagnosis: Effects on the poor and vulnerable. Lancet. 2004;364(9448):1896–8. https://doi.org/10.1016/S0140-6736(04)67466-1 (Published online).

20. Oyekale AS. Assessment of primary health care facilities’ service readiness in Nigeria. BMC Health Serv Res. 2017;17(1):172. https://doi.org/10.1186/s12913-017-1211-8 (Published online).

21. Ushie BA, Ugal DB, Ingwu JA. Overdependence on for-profit pharmacies: A descriptive survey of user evaluation of medicines availability in public hospitals in selected Nigerian states. PLoS One. 2016;11(11):e0165707. https://doi.org/10.1371/journal.pone.0165707 (Published online).

22. Muhammed KA, Umeh KN, Nair SM, Suleiman IH. Understanding the barriers to the utilization of primary health care in a low-income setting: Implications for health policy and planning. J Public Health Africa. 2013;4(2):e13. https://doi.org/10.4081/jpha.2013.e13 (Published online).

23. Kalyango JN, Rutembereberwa E, Alfenve T, Sali S, Peterson S, Karamagi C. Performance of community health workers under integrated community case management of childhood illnesses in Eastern Uganda. Malar J. 2012;11:282. https://doi.org/10.1186/1747-2775-11-282 (Published online).

24. Wandurup P, Tetu M, Tuhebwe D, et al. The performance of community health workers in the management of multiple childhood infectious diseases in Lira, northern Uganda - A mixed methods cross-sectional study. Glob Health Action. 2016;9:33194. https://doi.org/10.3402/gha.v9.33194 (Published online).

25. Druetz T, Siekmann K, Goossens S, Ridde V, Haddad S. The community case management of pneumonia in Africa: A review of the evidence. Health Policy Plan. 2015;30(2):235–66. https://doi.org/10.1093/heapol/czt104 (Published online).

26. Chinbuah MA, Abbey M, Kager PA, et al. Assessment of the adherence of community health workers to dosing and referral guidelines for the management of fever in children under 5 years: a study in Dangme West District Ghana. Int Health. 2013;5(2):148–56. https://doi.org/10.1093/inthealth/ihu008 (Published online).

Publisher’s Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.