

Private Sector Drug Shops in Integrated Community Case Management of Malaria, Pneumonia, and Diarrhea in Children in Uganda

Phyllis Awor,* Henry Wamani, Godfrey Bwire, George Jagoe, and Stefan Peterson

Department of Community Health and Behavioral Sciences, School of Public Health, Makerere University College of Health Sciences, Kampala, Uganda; Medicines for Malaria Venture, Kampala, Uganda; Medicines for Malaria Venture, Geneva, Switzerland; Division of Global Health, Karolinska Institute, Stockholm, Sweden; International Maternal and Child Health Unit, Uppsala University, Uppsala, Sweden

Abstract. We conducted a survey involving 1,604 households to determine community care-seeking patterns and 163 exit interviews to determine appropriateness of treatment of common childhood illnesses at private sector drug shops in two rural districts of Uganda. Of children sick within the last 2 weeks, 496 (53.1%) children first sought treatment in the private sector versus 154 (16.5%) children first sought treatment in a government health facility. Only 15 (10.3%) febrile children treated at drug shops received appropriate treatment for malaria. Five (15.6%) children with both cough and fast breathing received amoxicillin, although no children received treatment for 5–7 days. Similarly, only 8 (14.3%) children with diarrhea received oral rehydration salts, but none received zinc tablets. Management of common childhood illness at private sector drug shops in rural Uganda is largely inappropriate. There is urgent need to improve the standard of care at drug shops for common childhood illness through public–private partnerships.

INTRODUCTION

Fever-related conditions, including malaria, pneumonia, and diarrhea, are the major causes of mortality among children less than 5 years old in low-income countries.¹ In Uganda, the Home-Based Management of Fever (HBMF) strategy was initiated in 2002 to treat all febrile children with antimalarials. The HBMF strategy was promoted through public and community health worker systems. As a result, the community health workers' mandate has been broadened to use diagnostics such as rapid diagnostic tests (RDTs) for malaria and respiratory timers for pneumonia and treat febrile children with antimalarials, antibiotics, and oral rehydration salt with zinc tablets (ORS/Zinc) accordingly. This new approach is called the integrated community case management (iCCM) of malaria, pneumonia, and diarrhea in children, which is now national policy in Uganda.²

Whereas the iCCM strategy is implemented through volunteer community health workers, the majority of parents in Uganda seek care for their febrile children from private clinics and drug shops.^{3,4} Unfortunately, the standard of care in private health facilities, including drug shops, is not well-documented, although it is known to be wanting. There is need to study interventions aimed at improving the standard of care provided by the private sector in the management of common childhood illnesses.^{4,5}

In 2011, the Global Fund, through the Affordable Medicines Facility—Malaria (AMFm), began to subsidize and promote artemisinin combination therapy (ACT) for the treatment of fever through the private sector in eight low-income countries, including Uganda.⁶ Studies have shown that subsidizing ACT through private drug shops in rural areas can greatly increase ACT coverage for reported fevers.^{7,8} Unfortunately, there is no similar strategy to improve treatment of pneumonia and diarrhea in the private sector, where many sick children are first seen.

In addition, studies are exploring the feasibility of introducing malaria RDT in the private sector. However, there is extremely limited understanding of how to offer appropriate alternative treatment to those children with RDT-negative fever with or without signs of other illnesses.⁹ This lack of understanding limits the adherence to RDT results and leads to continued inappropriate use of ACT, with adverse consequences for cost, resistance development, and children suffering from other illnesses than malaria.^{10,11} Furthermore, there is also indication of increased likely inappropriate use of antibiotics to treat RDT negative fever.⁹

The private sector plays an important role for care of febrile children in Uganda. Through the AMFm, the role of the private sector may further be expanded for care of malaria. The objective of this study was to determine the role and appropriateness of care provided by private sector drug shops in treating childhood fever, respiratory symptoms, and diarrhea in Uganda.

METHODS

The study was conducted in two rural districts of Kaliro and Kamuli in eastern Uganda as part of a baseline assessment for a larger study determining the effectiveness of introducing and promoting pre-packaged drugs and diagnostics for treatment of childhood fever and diarrhea within drug shops in Uganda.

The two districts were purposively selected as representative of a typical rural setting with a high burden of febrile illness and diarrhea in children. The research strategy included a community household survey and exit interviews at drug shops to determine care-seeking patterns and the appropriateness of treatment provided at drug shops for febrile children less than 5 years of age in Uganda. All data were collected in May of 2011.

Household survey. A two-stage cluster sampling using probability proportional to population size was used to select 1,604 households with children less than 5 years of age in both study districts. At the first stage, a probability sample of 30 villages/clusters was sampled. At the second stage, 26 target households were sampled from each cluster. Because of

*Address correspondence to Phyllis Awor, Department of Community Health and Behavioral Sciences, School of Public Health, Makerere University College of Health Sciences, 7072 Kampala, Uganda. E-mail: pawor@musph.ac.ug

the lack of an updated village list of households, it was not possible to have a random sample within a cluster. The study team, therefore, randomly identified a starting point from a list of households obtained from the local leaders and thereafter, sampled every fifth household with children less than 5 years of age. The main caretaker (usually the mother) aged 15 years and above was interviewed face to face using a semistructured questionnaire. If a sampled house was empty or the caregiver was absent, it was replaced by the neighboring house. The questionnaire was designed to elicit care-seeking practice for the most recent illness (less than 2 weeks before the interview).

Five-day training was conducted for data collectors, and it included a pilot within a cluster that was not included in the survey. Five field teams collected the data, and a team was comprised of four data collectors and one supervisor.

Exit interviews at drug shops. One-half of all the licensed/registered drug shops in the two study districts were randomly selected for exit interviews (*N* = 40). All clients exiting the

drug shops were approached and requested to be interviewed if they had come to the drug shop seeking treatment of a child less than 5 years of age. Data collectors were at the drug shop all day (from 8:30 AM to 7:00 PM) during the study period, and 163 interviews were conducted.

A semistructured questionnaire was used. The questions asked included what the child's symptoms were, when the current illness was noticed, and any care sought before coming to the drug shop. We asked for all the medicines purchased and noted down information, including drug name, dosage, duration of treatment, and whether instructions were given on how to use the purchased medicines.

The data were entered separately for the household and exit interviews in Epi data software, and they were analyzed using SPSS. Ethical approval was obtained from the Makerere University School of Public Health Higher Degrees Research and Ethics Committee as well as the Uganda National Council of Science and Technology. Informed consent was obtained from all the study participants.

TABLE 1

Baseline characteristics of the study population (*N* = 1,604)

Median age (years) of primary caregiver/respondent (IQR)	28 (23, 35)
Median age (months) of child (IQR)	14 (7, 24)
Median household size (IQR)	6 (4, 8)
Median number of children less than 5 years old in the household (IQR)	2 (1, 2)
Educational background of caretaker/respondent	
No education	308 (19.2%)
Primary level	908 (56.6%)
Secondary level	362 (22.6%)
Higher education	26 (1.6%)
Household head	
Self (caretaker/respondent)	212 (13.2%)
Partner/husband	1,323 (82.5%)
Other male adult	52 (3.2%)
Other female adult	17 (1.1%)
Educational background of partner/husband (<i>N</i> = 1,568; some have no partner)	
No education	138 (8.8%)
Primary level	809 (51.6%)
Secondary level	422 (26.9%)
Higher education	72 (4.6%)
Do not know	127 (8.1%)
Occupation of partner/husband (<i>N</i> = 1,568)	
Farmer	896 (57.1%)
Trader	91 (5.8%)
Civil servant	94 (6.0%)
Other office work	54 (3.4%)
Business man/self-used	346 (22.1%)
Unemployed	26 (1.7%)
Do not know	61 (3.9%)
Who makes the decision to seek medical treatment when a child is sick?	
Mother	854 (53.2%)
Husband	312 (19.5%)
Mother and husband together	402 (25.1%)
Relatives/others	36 (2.2%)
Who authorizes expenditure for treatment of sick children in household?	
Mother	163 (10.2%)
Husband	1,173 (73.1%)
Mother and husband together	220 (13.7%)
Relatives/others	48 (3%)
Ownership of house	
Self-owned	1,394 (86.9%)
Rented	123 (7.7%)
Relative (pays no rent)	85 (5.3%)
Other	2 (0.1%)

RESULTS

The median (interquartile range [IQR]) age of the primary caregiver, number of children less than 5 years old, and household size were 28 (23, 35) years, 2 (1, 2) children, and 6 (4, 8), respectively (Table 1). The decision to seek treatment of the ill child was usually made by the mother in 854 (53.2%) households, whereas the father/husband mainly authorized expenditure for treatment of sick children in 1,173 (73.1%) households.

Up to 934 (58%) children had been sick within the previous 2 weeks of the study (Table 2). The number of children with an illness within the last 2 weeks who first sought treatment in the private sector (private clinics and drug shops) was 496 (53.1%) versus 154 (16.5%) in a government health facility. Caregivers who first managed the sick child at home were 228 (24.4%), whereas 31 (3.3%) caregivers first visited a community health worker, 13 (1.4%) caregivers first visited a traditional healer, and 12 (1.3%) caregivers first visited a spiritual healer or the church.

The median (IQR) age of children for whom treatment was sought at the drug shop was 15 (9, 36) months; 65% of the caretakers who bought drugs for sick children at the drug shops were female, and their education level was primary in 75 (52.8%) and ordinary level in 53 (37.3%) women. The main presenting complaint/symptoms for which treatment was sought at the drug shop was fever in 145 (89%), cough in 100 (61.3%), and diarrhea in 56 (34.4%) children. Both cough

TABLE 2

First point where care was sought for illness within the last 2 weeks in a child less than 5 years of age (*N* = 934)

Healthcare service provider	Number (%)
Private health provider	496 (53.1)
Drug shop	279 (29.9)
Private clinic	217 (23.2)
Managed at home	228 (24.4)
Government health facility	154 (16.5)
Rural health center	120 (12.8)
Hospital	34 (3.6)
Community health worker	31 (3.3)
Traditional healer	13 (1.4)
Spiritual healer/church	12 (1.3)

TABLE 3

Symptoms of the child for whom treatment was sought at the drug shop

Symptom/complaint (<i>N</i> = 163)	Number (%) ^a
Fever	145 (89)
Cough	100 (61.3)
Rapid/difficult breathing	40 (24.5)
Cough and rapid/difficult breathing	32 (19.6)
Diarrhea	56 (34.4)
Vomiting	20 (12.3)
Others	37 (22.7)

^aThe total is more than 100%, because more than one complaint is possible.

and rapid/difficult breathing were the presenting complaint in 32 (19.6%) children (Table 3).

Of all children with fever for whom treatment was sought at a drug shop, only 15 (10.3%) children received appropriate treatment according to current national guidelines with an ACT for 3 days and within 24 hours of onset of illness (Table 4). For children who presented with cough and fast breathing—defined as pneumonia according to the iCCM guidelines—23 (71.9%) children received an antibiotic, although it was mainly cotrimoxazole (56.3%). Only 5 (15.6%) children were treated with the recommended first-line drug of amoxicillin. However, zero children with cough and fast breathing received amoxicillin for the recommended duration of 5–7 days. Similarly, only 8 (14.3%) children with diarrhea were treated with ORS, and none of the children with diarrhea received zinc tablets.

TABLE 4

Appropriateness of treatment obtained from drug shops

Appropriateness of treatment of fever, cough with rapid/fast breathing and diarrhoea	Number (%)
Treatment of fever (<i>N</i> = 145)	
Proportion of children with fever receiving any ACT drug	37 (25.5)
Proportion of children with fever receiving any ACT for 3 days	27 (18.6)
Proportion of children with fever receiving any ACT within 24 hours	22 (15.2)
Proportion of children with fever receiving any ACT within 24 hours of onset of fever and for 3 days	15 (10.3)
Proportion of children with fever receiving any ACT within 24 hours of onset of fever and for less than 3 days	1 (0.7)
Proportion of children with fever receiving any ACT within 24 hours of onset of fever and for more than 3 days	6 (4.1)
Treatment of cough with rapid/fast breathing (<i>N</i> = 32)	
Proportion of children with both cough and fast breathing treated with any antibiotic (amoxicillin, cotrimoxazole, or any other antibiotic)	23 (71.9)
Proportion of children with both cough and fast breathing treated with cotrimoxazole only	18 (56.3)
Proportion of children with both cough and fast breathing treated with amoxicillin	5 (15.6)
Proportion of children with both cough and fast breathing treated with amoxicillin for 5–7 days	0
Treatment of diarrhea (<i>N</i> = 56)	
Proportion of children with diarrhea treated with ORS	8 (14.3)
Proportion of children with diarrhea treated with ORS and zinc	0

TABLE 5

Accessibility and affordability of drugs from the drug shop (*N* = 163)

Bought drugs without a prescription	108 (66.3%)
Reason for choosing the drug shop	
Good service/customer care	101 (62%)
Distance (proximity)	34 (20.9%)
Good/trained staff	32 (19.6%)
Regular supply of drugs	23 (14.1%)
Drug seller is my friend	22 (13.5%)
How long does it take to walk from home to this drug shop?	
Less than 15 minutes	51 (31.3%)
15–30 minutes	42 (25.8%)
30–60 minutes	39 (23.9%)
1–2 hours	19 (11.7%)
Spent money to get to drug shop?	60 (36.8%)
Median amount spent (range)	1,000 Ugshs (200–7,500)
Walking distance to the nearest public health facility	
Less than 15 minutes	34 (20.9%)
15–30 minutes	39 (23.9%)
30–60 minutes	35 (21.5%)
1–2 hours	28 (17.2%)
Was not able to afford all drugs prescribed/advised	47 (28.8%)
Why not able to buy all drugs? (<i>N</i> = 47)	
I did not have enough money	42 (89.4%)
When buying drugs, what determines the amount that you buy?	
The dosage prescribed	65 (39.9%)
The amount of money that I have	78 (47.8%)
Other	20 (12.3%)
How do you rate prices in the drug shop with respect to your ability to buy them?	
Too expensive	50 (30.7%)
Prices within my reach	113 (69.3%)

Up to 108 (66.3%) caretakers bought drugs from the drug shops without a prescription (Table 5). Although the amount of money available to a care-seeker determined the amount of drugs bought in 78 (47.8%) cases, the prices of drugs were reported to be within reach of the majority (113; 69.3%). The main reasons for seeking care at the drug shop included perceived good service/customer care in 101 (62%) cases, distance/proximity in 34 (20.9%) cases, good/trained staff in 32 (19.6%) cases, regular supply of drugs in 23 (14.1%) cases, and the drug seller being a friend in 22 (13.5%) cases (Table 5).

DISCUSSION

In this study, we have documented that the majority of parents/caretakers in two districts in rural Uganda take their febrile children to the private sector and that the care that they receive at drug shops for treatment of the main diseases causing pediatric death is inadequate. The significant role of the private sector in healthcare delivery has been previously described. The work by Rutebemberwa and others³ showed that 62.7% of care for febrile children sought outside the home was first obtained from drug shops/private clinics. Our study confirms this finding, with more than one-half of all care for children less than 5 years of age being first sought in private drug shops and clinics. This finding is also in agreement with the finding in the work by Konde-Lule and others⁴ that private providers play a major role in healthcare delivery in rural Uganda.

However, we document that the care received at private drug shops is poor. According to the current Ugandan iCCM guidelines for management of fever, cough, and diarrhea, only 10% of febrile children were correctly managed in our study (that is, correct treatment with ACT for the correct duration and within 24 hours of onset of illness). Management of cough with fast breathing at the drug shops was even worse, with no children receiving the recommended drug—amoxicillin—for the correct duration of time. Also, no child with diarrhea received ORS with zinc tablets according to current treatment guidelines. This more comprehensive assessment of correct management for a range of symptoms shows similar results to previous studies of the appropriateness of care provided by the private sector to sick children less than 5 years of age.^{5,12,13}

Although drug shops in Uganda are commonly owned and registered by middle-level health workers, they are usually manned by either lower-level nurses (nursing assistants who have some level of medical training that allows them to manage simple health problems like treatment of fever) or people with no previous medical training.¹⁴ Generally, most drug shop attendants have some secondary school education. Given the poor management of childhood malaria, pneumonia, and diarrhea by drug shop attendants and their limited medical training, there is urgent need for more effective training and supervision in this part of the private sector.^{5,14}

Although both drug shops and government facilities were a similar distance from their homes, 62% of the caretakers interviewed reported that the reason that they chose to seek care at a drug shop was because of good service/customer care. Poor interpersonal handling of patients and longer waiting time at government facilities as well as lack of trust in staff at public health facilities have been reported as reasons for preferred use of private drug shops for acute febrile illness.¹⁵ Improving customer experience at public health facilities could, thus, contribute to increased use of these facilities.

The Global Fund now supports the AMFm with subsidized ACT through the private sector in eight countries. It has ambitions to increase prompt access to effective antimalarials, particularly to increase ACT affordability, availability, and use and crowd out artemisinin monotherapies, chloroquine, and sulfadoxine-pyrimethamine by gaining market share. Challenges for the AMFm include ensuring that the subsidy is passed on to consumers, increasing access to diagnostic confirmation, reaching the poor and remote, and identifying appropriate benchmarks to evaluate the AMFm pilots.¹⁶ Although increasing prompt access to ACT through the private sector through subsidies has been shown to be feasible,⁷ this access may well come at the expense of rational use when ACT is used to treat fever presumptively. The experience of introducing ACT and malaria RDT in the private sector in Cambodia over the last 10 years has shown challenges in maintaining constant supply and determining effective incentives for private providers and consumers to use the RDT and adhere to their results.¹⁷ There may also be inadvertent effects on the use of antibiotics. Studies from Zanzibar¹⁸ and mainland Tanzania⁹ have shown dramatically increased prescription rates for antibiotics when RDTs were introduced, particularly in RDT-negative cases.

We hypothesize that adherence to test results, adequate management of the febrile child, and rational use of ACT as well as antibiotics may be dependent on diagnostics for malaria as well as pneumonia (respiratory timers) and alter-

native appropriate treatment being provided, including paracetamol, to the likely majority of patients who do not fulfill the criteria for antimalarial or antibiotic treatment. With changing epidemiology of malaria and pneumonia, this group will be a higher and higher proportion of children.¹⁹

To realize the full potential of ACT and RDT to treat malaria and adequately cater to the febrile child, it may, therefore, be important to extend the logic and policy recommendation of integrated community case management of febrile illness to the private sector. This extension will be in support of the World Health Organization (WHO)/United Nations Children's Fund (UNICEF) recommendations for managing childhood febrile illnesses²⁰ and further explore opportunities to enhance public-private partnerships. We are now undertaking a proof-of-concept study of iCCM in registered drug shops in Uganda and encourage others to do the same in other settings.

Methodological considerations. Part of the data presented was based on caretaker's report of child's illness. This method is prone to both recall and reporting bias, where a respondent may not remember relevant details of the illness and may report what they think is expected of them, respectively. The use of exit interviews minimized recall bias, because we asked about a child's current illness and which drugs were bought at a drug shop. We also minimized recall bias by considering only illness that occurred within 2 weeks of the household interviews, which is a standard and acceptable method applied in similar cross-sectional surveys. The results obtained are comparable with other studies. However, selection bias remains relevant when exit interviews are used, because people who seek care from private drug shops may be different from the general population.

Conclusion. The majority of parents in Uganda first seek care for febrile children in the private sector, notably drug shops and private clinics. However, febrile children mostly receive inappropriate treatment at the private sector drug shops. This finding means that there is a missed opportunity for them to access appropriate and timely treatment of fever, cough, and diarrhea at this level. There is urgent need to improve the standard of care provided at drug shops through a mix of appropriate technical solutions (drugs and diagnostics), training, incentives, regulation, supervision and information, education, and communication. Public-private partnerships would provide an adequate avenue for such improvements.

Received December 20, 2011. Accepted for publication February 24, 2012.

Acknowledgments: We are grateful to the Einhorn Family Foundation—Sweden for funding this study and the Medicines for Malaria Venture for field support.

Authors' addresses: Phyllis Awor, Mulago Hospital, Kampala, Uganda, E-mail: pawor@musph.ac.ug. Henry Wamani, Makerere University, College of Health Sciences, School of Public Health—Community Health and Behavioral Sciences, Kampala, Uganda, E-mail: hwamani@musph.ac.ug. Godfrey Bwire and George Jagoe, Global Access Division, Medicines for Malaria Venture, Kampala, Uganda, E-mails: sgbwire@yahoo.com and jagoeg@mmv.org. Stefan Peterson, Division of Global Health, Karolinska Institute, Stockholm, Sweden and International Maternal and Child Health Unit, Uppsala University, Uppsala, Sweden, E-mail: s.peterson@ki.se.

REFERENCES

1. Black RE, Morris SS, Bryce J, 2003. Where and why are 10 million children dying every year? *Lancet* 361: 2226–2234.

2. Ministry of Health, 2010. *Intergrated Community Case Management of Childhood Malaria, Pneumonia and Diarrhoea: Implementation Guide*. Kampala, Uganda: Ministry of Health.
3. Rutebemberwa E, Pariyo G, Peterson S, Tomson G, Kallander K, 2009. Utilization of public or private health care providers by febrile children after user fee removal in Uganda. *Malar J* 8: 45.
4. Konde-Lule J, Gitta SN, Lindfors A, Okuonzi S, Onama VO, Forsberg BC, 2010. Private and public health care in rural areas of Uganda. *BMC Int Health Hum Rights* 10: 29.
5. Tawfik Y, Nsungwa-Sabitii J, Greer G, Owor J, Kesande R, Prysor-Jones S, 2006. Negotiating improved case management of childhood illness with formal and informal private practitioners in Uganda. *Trop Med Int Health* 11: 967–973.
6. Global Fund, 2011. *Affordable Medicines Facility—Malaria*. Available at: <http://www.theglobalfund.org/en/amfm/>. Accessed October 28, 2011.
7. Kangwana BP, Kedenge SV, Noor AM, Alegana VA, Nyandigisi AJ, Pandit J, Fegan GW, Todd JE, Brooker S, Snow RW, Goodman CA, 2011. The impact of retail-sector delivery of artemether-lumefantrine on malaria treatment of children under five in Kenya: a cluster randomized controlled trial. *PLoS Med* 8: e1000437.
8. Sabot OJ, Mwita A, Cohen JM, Ipuge Y, Gordon M, Bishop D, Odhiambo M, Ward L, Goodman C, 2009. Piloting the global subsidy: the impact of subsidized artemisinin-based combination therapies distributed through private drug shops in rural Tanzania. *PLoS One* 4: e6857.
9. D'Acremont V, Kahama-Marro J, Swai N, Mtasiwa D, Genton B, Lengeler C, 2011. Reduction of anti-malarial consumption after rapid diagnostic tests implementation in Dar es Salaam: a before-after and cluster randomized controlled study. *Malar J* 10: 107.
10. D'Acremont V, Lengeler C, Mshinda H, Mtasiwa D, Tanner M, Genton B, 2009. Time to move from presumptive malaria treatment to laboratory-confirmed diagnosis and treatment in African children with fever. *PLoS Med* 6: e252.
11. Kallander K, Hildenwall H, Waiswa P, Galiwango E, Peterson S, Pariyo G, 2008. Delayed care seeking for fatal pneumonia in children aged under five years in Uganda: a case-series study. *Bull World Health Organ* 86: 332–338.
12. Nshakira N, Kristensen M, Ssali F, Whyte SR, 2002. Appropriate treatment of malaria? Use of antimalarial drugs for children's fevers in district medical units, drug shops and homes in eastern Uganda. *Trop Med Int Health* 7: 309–316.
13. Ringsted FM, Massawe IS, Lemnge MM, Bygbjerg IC, 2011. Saleability of anti-malarials in private drug shops in Muheza, Tanzania: a baseline study in an era of assumed artemisinin combination therapy (ACT). *Malar J* 10: 238.
14. Konde-Lule J, Okuonzi S, Matsiko C, Mukanga D, Onama V, Nakacubo SG, 2006. *The Potential of the Private Sector to Improve Health Outcomes in Uganda*. Kampala, Uganda: Makerere University School of Public Health.
15. Chuma J, Gilson L, Molyneux C, 2007. Treatment-seeking behaviour, cost burdens and coping strategies among rural and urban households in coastal Kenya: an equity analysis. *Trop Med Int Health* 12: 673–686.
16. Adeyi O, Atun R, 2010. Universal access to malaria medicines: innovation in financing and delivery. *Lancet* 376: 1869–1871.
17. Yeung S, Patouillard E, Allen H, Socheat D, 2011. Socially-marketed rapid diagnostic tests and ACT in the private sector: ten years of experience in Cambodia. *Malar J* 10: 243.
18. Msellem MI, Martensson A, Rotllant G, Bhattarai A, Strömberg J, Kahigwa E, Garcia M, Petzold M, Olumese P, Ali A, Björkman A, 2009. Influence of rapid malaria diagnostic tests on treatment and health outcome in fever patients, Zanzibar: a crossover validation study. *PLoS Med* 6: e1000070.
19. English M, Scott JA, 2008. What is the future for global case management guidelines for common childhood diseases? *PLoS Med* 5: e241.
20. WHO/UNICEF, 2004. *Management of Pneumonia in Community Settings*. Geneva: World Health Organization/United Nations Children's Fund.