

## Retail supply of malaria-related drugs in rural Tanzania: risks and opportunities

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### Summary

**OBJECTIVES** To characterize availability of fever and malaria medicines within the retail sector in rural Tanzania, assess the likely public health implications, and identify opportunities for policy interventions to increase the coverage of effective treatment.

**METHODS** A census of retailers selling drugs was undertaken in the areas under demographic surveillance in four Tanzanian districts, using a structured questionnaire.

**RESULTS** Drugs were stocked by two types of retailer: a large number of general retailers ( $n = 675$ ) and a relatively small number of drug shops ( $n = 43$ ). Almost all outlets stocked antipyretics/painkillers. One-third of general retailers stocking drugs had antimalarials, usually chloroquine alone. Almost all drug shops stocked antimalarials (98%); nearly all had chloroquine, 42% stocked quinine, 37% sulphadoxine–pyrimethamine and 30% amodiaquine. A large number of antimalarial brands were available. Population ratios indicate the relative accessibility of retail drug providers compared with health facilities. Drug shop staff generally travelled long distances to buy from drugs wholesalers or pharmacies. General retailers bought mainly from local general wholesalers, with a few general wholesalers accounting for a high proportion of all sources cited.

**CONCLUSIONS** Drugs were widely available from a large number of retail outlets. Potential negative implications include provision of ineffective drugs, confusion over brand names, uncontrolled use of antimalarials, and the availability of components of potential combination therapy regimens as monotherapies. On the other hand, this active and highly accessible retail market provides opportunities for improving the coverage of effective antimalarial treatment. Interventions targeted at all drug retailers are likely to be costly to deliver and difficult to sustain, but two promising points for targeted intervention are drug shops and selected general wholesalers. Retail quality may also be improved through consumer education, and modification of the chemical quality, packaging and price of products entering the retail distribution chain.

**keywords** malaria, private sector, developing countries, antimalarials, Tanzania, rural areas

### Introduction

The private sector is recognized as a major source of malaria treatment in Africa. In many settings over 50% of febrile episodes are treated through retailers, encompassing pharmacists, drug shop staff with minimal medical qualifications, and shopkeepers and street vendors with no medical training (Deming *et al.* 1989; Ejezie *et al.* 1990; Yeneneh *et al.* 1993; Ndyomugenyi *et al.* 1998; Molyneux *et al.* 1999; Hamel *et al.* 2001). Because of the importance of this source of treatment and the rapidity

with which *Plasmodium falciparum* malaria can progress to severe disease (Greenwood *et al.* 1987) and death (Nájera & Hempel 1996) good quality treatment practices at retail outlets are essential. Moreover widespread uncontrolled drug use, including substandard drugs and under-dosing may contribute to the spread of antimalarial drug resistance (White 1999), increasing the need for improved practices within the private sector.

Resistance to chloroquine, which had been the national first-line treatment for malaria in most of Africa for generations, is widespread and has resulted in millions

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receiving ineffective therapy. There is intense debate about appropriate replacement drugs and how best to deploy them programmatically (White *et al.* 1999; Bloland *et al.* 2000; WHO 2000). Combination therapy, the simultaneous use of two or more drugs with independent modes of action, has been promoted as a strategy to improve therapeutic efficacy and delay the development of drug resistance (White 1999; Kindermans *et al.* 2002).

Appropriate retail sector provision is a prerequisite for improvements in malaria treatment in general. Effective implementation of combination therapy is also likely to require high coverage of the combination and limited use of the combination components as single agents in the retail sector (Bloland *et al.* 2000). However, little is known about African retail drugs markets or potential points for policy intervention (Goel *et al.* 1996; Bloland & Ettlting 1999; Brugh *et al.* 1999; Le Grand *et al.* 1999).

These are critical issues for Tanzania, where malaria is endemic in almost all areas, and is the leading cause of outpatient visits and inpatient deaths (Tanner *et al.* 1991; Ministry of Health 1998). High levels of drug resistance led the Tanzanian government to abandon chloroquine in 2001, introducing sulphadoxine–pyrimethamine (SP) monotherapy as first-line therapy. Policy makers are considering future use of combination therapy, and are investigating potential ways to work with the retail sector to improve the treatment of fevers suspected to be due to malaria.

We aimed to identify the risks posed by retail sector malaria treatment, and the opportunities it affords for improving access to prompt, effective treatment. We conducted a census of rural drug outlets, documenting the type of shops, the products stocked and their sources of wholesale supply. This represents one of the first large-scale studies of drug availability in rural Africa; it is an essential foundation for developing policy on malaria treatment within the retail sector, and will help guide effective implementation of combination therapy in the future.

## Methods

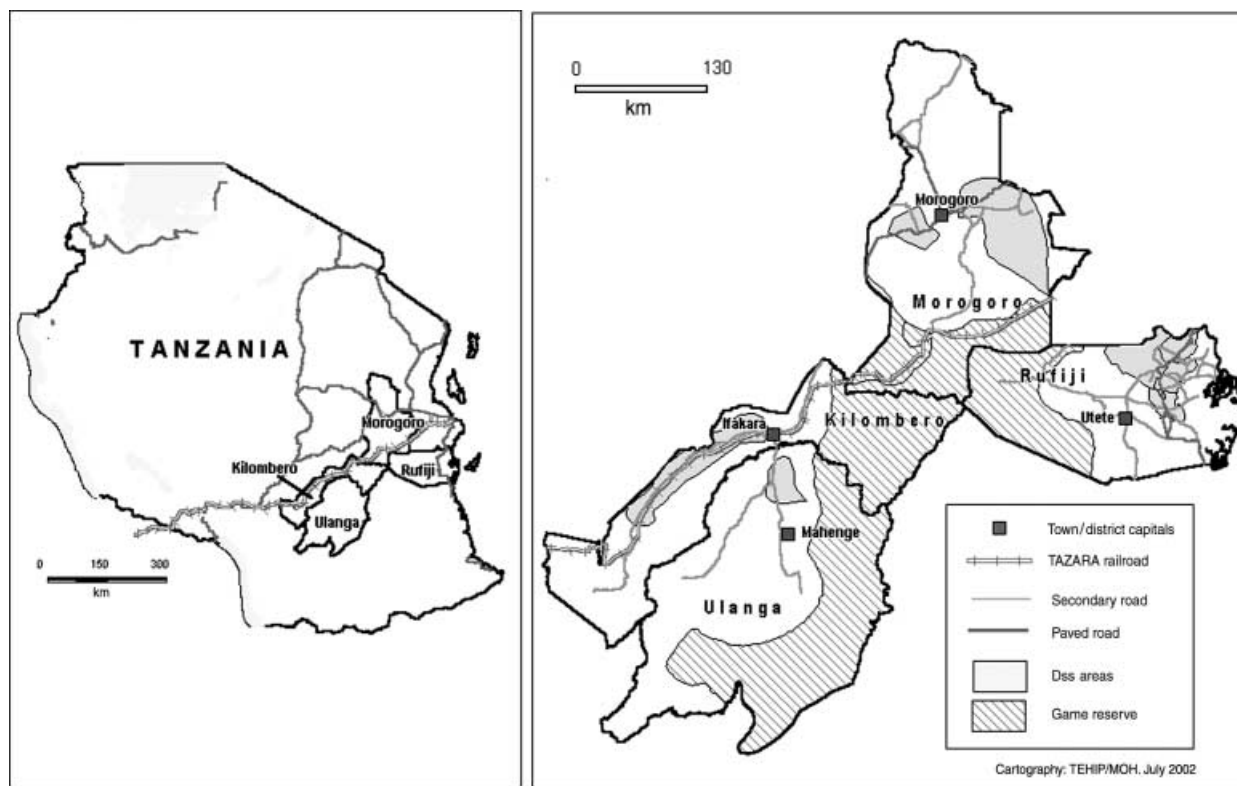
We conducted the study in the areas of Ulanga, Kilombero, Morogoro (Rural District Council) and Rufiji districts covered by demographic surveillance systems (DSS), between May and August 2000, during the latter part of the high malaria transmission season (INDEPTH Network 2002). The districts are located in south-eastern Tanzania, 150–400 km from Dar-es-Salaam (Figure 1), and are predominantly rural with few paved roads. Malaria transmission is intense and perennial. The DSS areas had a combined population of 222 749 in 2001, served by

51 primary health care facilities (33 government-owned, 10 run by missions, five parastatal and three commercial). As in most of rural Tanzania, malaria diagnosis in the majority of health care facilities and shops was based on clinical symptoms alone, relying mainly on reported fever. At the time of the study, chloroquine was still the first-line treatment for malaria and SP the second line.

The census of outlets covered all retail sources of manufactured drugs in the DSS areas, including general retailers and pharmacies. There were two types of pharmacy in Tanzania. Part I pharmacies must be run by a registered pharmacist, and could sell any Tanzanian-registered drug. Part II pharmacies, or drug shops, could be run by anyone with a minimum of 4 years medical training (e.g. nurse, pharmacy assistant), and were legally permitted to stock only over-the-counter products such as painkillers and oral formulations of chloroquine and amodiaquine. They were not permitted to stock any other antimalarials, nor any antibiotics or injectables. General retailers were not permitted to sell drugs officially but in practice, the government allowed the sale of over-the-counter products, including oral chloroquine.

Data were collected by DSS staff in Rufiji, Kilombero and Ulanga, and by a separate team in Morogoro. A common problem in the study of retailers is the lack of a good quality sampling frame. In Rufiji, Kilombero and Ulanga DSS field staff drew up a list of all outlets that might sell drugs, categorized by outlet type. The 30 field staff in Kilombero/Ulanga, and 39 in Rufiji knew the areas very well as they worked in teams that covered a small geographical area, lived in the communities where they worked, and visited each household every 4 months. Any queries on the sampling frame were checked during their regular fieldwork. In Morogoro, interviewers worked with local village officials to list all potential drug sources; the lack of local field staff may have led the Morogoro sampling frame to be less complete. In all districts, lists were updated if any additional outlets were identified during data collection.

Interviewers visited each outlet and administered a structured questionnaire in Kiswahili covering products stocked in three therapeutic classes (antipyretics/painkillers, antimalarials and antibiotics); and wholesale drug sources. A preliminary checklist of common brand names was developed through piloting in local shops. The checklist was read out to the interviewee, who was also asked whether they had any other drugs in these categories. The interviewer checked visually that each drug reported was in stock. Informed consent was obtained from retailers. As they might have been unwilling to disclose information perceived as commercially or legally sensitive, especially concerning drugs they were not legally permitted

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**Figure 1** Location of study districts and demographic surveillance system (DSS) areas. *Source:* Map courtesy of TEHIP.

to sell, they were assured that the study was not connected with the tax or drug regulatory authorities, and that data collected would be confidential. The study received ethical approval from the institutional review boards of the Ifakara Health Research and Development Centre and the Centers for Disease Control and Prevention, and the national Tanzanian Medical Research Co-ordinating Committee.

Data were double entered using FoxPro 2.6a, and checked for logical consistency and coding errors. Analysis was performed using STATA 7. The chi-square test was used to test for differences in proportions (with exact binomial confidence intervals), and the Wilcoxon rank-sum test for differences in medians. Statistical comparisons were considered significant for  $P$  values  $<0.05$ .

## Results

### Retail outlets stocking drugs

We initially identified 834 retail outlets, and 808 interviews were completed. Of those not interviewed, 14 had closed permanently, five were temporarily closed, and in one case

no reason was recorded. Only six outlets refused to participate (0.7% of functioning outlets).

The local knowledge of data collection staff facilitated the identification of outlets, but it is possible that a few were missed. To assess this we analysed treatment sources in the DSS areas recorded in a contemporaneous household survey. Less than 7% of shops specified by householders could not be matched with those listed in the census, and in some cases this may reflect the use of different names for a given shop. We concluded that we had identified nearly all retail pharmaceutical outlets used by the population at the time of the study. Although some drugs were stocked illegally, the information sought did not appear unduly sensitive, as  $<1\%$  of open shops refused to participate and many sellers reported stocking products they were not legally permitted to sell. However, as these were often hidden under the shop counter or in a side room, reported stocks are a minimum estimate.

On the day visited, 718 retail outlets had drugs in stock, comprising 43 part II drug shops and 675 general retailers (Table 1). There were no Part I pharmacies in the DSS areas. An additional 21 general retailers had no drugs on the day of interview but reported having stocked drugs

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	Demographic Surveillance System (DSS) area				Total
	Ulanga	Kilombero	Morogoro	Rufiji	
Drug shops	2	8	20	13	43
General retailers stocking drugs	106	146	194	229	675
Total retailers stocking drugs	108	154	214	242	718
Population* (May 2000)	28 011	31 990	88 842	73 906	222 749
Population per retailer stocking drugs	259	208	415	305	310

\* Source of population data: Ifakara Centre Demographic Surveillance System, Tanzanian Essential Health Interventions Project (TEHIP), the Adult Morbidity and Mortality Project (AMMP) of the Ministry of Health.

within the previous 2 months. The general retailers ranged from large permanent shops to small temporary roadside stalls, and stocked a wide range of household products such as soap powder and cooking oil. The ratio of population to retail drug source is presented in Table 1.

### Drugs stocked

Almost all outlets selling drugs stocked antipyretics/painkillers such as paracetamol and aspirin (Table 2a). Antimalarials were stocked by nearly all drug shops, but by only a third of general retailers who stocked drugs. Antibiotics were less available, stocked by two-thirds of drug shops and only 6% of general retailers stocking drugs. Within the antibiotic class, we were particularly interested in cotrimoxazole because of its antimalarial action and potential contribution to resistance against SP and related drugs (Iyer *et al.* 2001). Nearly two-thirds of drug shops stocked cotrimoxazole in either tablet or syrup form, but <1% of general retailers did so. The median number of products stocked in each category was significantly higher in drug stores than in general stores ( $P < 0.001$ ); 36% of drug stores had six or more antimalarials in stock, and 37% six or more antibiotics

**Table 1** Number of retailers with drugs in stock

(Table 2b). There were differences across DSS areas in the percentage of general retailers stocking antimalarials (ranging from 15% in Ulanga to 45% in Morogoro), and antibiotics (ranging from 3% in Rufiji to 13% in Kilombero) ( $P < 0.001$ ).

Of the general retailers stocking antimalarials, nearly all had chloroquine. Other antimalarials were very rarely found in general stores, and artemisinin derivatives were never available (Figure 2). A much wider range of antimalarials was available in drug shops; nearly all had chloroquine, and 42% stocked quinine, 37% SP and 30% amodiaquine, but only one stocked artemisinin derivatives. Injectable formulations of chloroquine or quinine were stocked by 44% of drug shops, but not by general retailers.

We found many different chloroquine products: nine brands of tablets, three of syrup, and one injectable, plus unbranded versions of each formulation. The two most frequently stocked brands were manufactured in Kenya. There were five brands of SP tablets and five brands of amodiaquine tablets, with the two most frequently stocked brands of SP from Europe, and of amodiaquine, from Kenya and India. A quarter of the chloroquine and amodiaquine products in tablet form were unbranded,

	Drug shops ( $n = 43$ )			General retailers ( $n = 675$ )			$P$ value‡
	Frequency	%†	95% CI	Frequency	%†	95% CI	
Antipyretics/painkillers	43	100	92–100	666	99	97–99	0.446
Antimalarials	42	98	88–100	225	33	30–37	<0.001
Antibiotics	28	65	49–79	43	6	5–8	<0.001

† Percentage of total retailers interviewed of each type stocking any drugs.

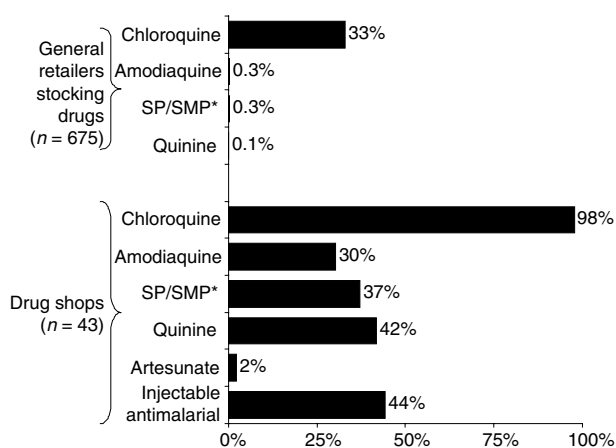
‡  $P$  value <0.05 indicates a statistically significant difference between drug shops and general retailers, by chi-square test.

**Table 2a** Drugs stocked by retailers by therapeutic class

C. Goodman *et al.* Retail supply of malaria-related drugs in Tanzania**Table 2b** Number of products stocked\*

Number of products	Drug shops ( <i>n</i> = 43)			General retailers ( <i>n</i> = 675)		
	1–5	6–10	>10	1–5	6–10	>10
Antipyretics/painkillers (%)	51	44	5	82	17	0.5
Antimalarials (%)	61	29	7	33	0.2	–
Antibiotics (%)	28	21	16	6	–	–

\* Including all formulations (tablets, syrup and injectables).



**Figure 2** Antimalarials stocked by retailers. \* SP category includes sulphadoxine–pyrimethamine and sulphamethoxypyrazine–pyrimethamine products.

compared with only 6% for SP. No quinine products were sold by brand name. Many shops stocked several brands of each antimalarial type. The maximum number of

chloroquine and SP products stocked by a single shop was 11 and five respectively.

### Source of wholesale supplies

Drug shops generally used dedicated drug suppliers, with 87% of sources specified being drug wholesalers or Part I pharmacies (Table 3). The suppliers were most commonly located in Dar es Salaam (60%) although the drug shops were typically located several hundred kilometres from the city. By contrast, 92% of sources mentioned by general retailers were general wholesalers, who stock a wide range of other products. Whether general retailers stocked antimalarials did not affect the type of wholesale source used ( $P = 0.12$ ). General retailers' sources were usually located in District or Regional headquarters (46%), or in 'minor settlements' (rural market centres) (41%). Mobile distributors who travel from retailer to retailer were never mentioned at drug shops, and were not a common source for general retailers (1% of sources specified).

Although general retailers mentioned a large number of different wholesalers, a few accounted for a high

**Table 3** Type and location of retailers' wholesale sources for drug supplies\*

	Drug shops		General retailers	
	Frequency	%†	Frequency	%†
Type of wholesale source‡				
General wholesaler or retailer	5	8	859	92
Drugs wholesaler or Part I pharmacy	52	87	37	4
Part II drug shop	3	5	24	3
Distributor	–	–	14	1
Total sources specified	60	100	934	100
Location of wholesale source‡				
Dar es Salaam	36	60	125	13
District/regional headquarters	24	40	445	46
Minor settlement	–	–	392	41
Total locations specified	60	100	962	100

\* Interviewees were asked to name up to two sources of drug supplies for their shop.

† Percentage of all sources/locations specified.

‡ There was a significant difference between drug shops and general retailers in type and location of wholesale sources ( $P < 0.001$ ).

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	Demographic Surveillance System (DSS) area				Mean
	Ulanga ( <i>n</i> = 106)	Kilombero ( <i>n</i> = 146)	Morogoro ( <i>n</i> = 194)	Rufiji ( <i>n</i> = 229)	
Top 3 sources	59 (56%)	70 (48%)	66 (34%)	118 (52%)	47%
Top 5 sources	67 (63%)	78 (53%)	82 (42%)	147 (64%)	56%

**Table 4** General retailers with drugs in stock mentioning at least one of the top 3 and top 5 wholesale sources

proportion of all sources cited (Table 4). In the Kilombero DSS area for example, of the 146 general retailers, 107 named a specific source, with a total of 36 different wholesalers mentioned. However, over half the retailers mentioned at least one of the five most frequently specified wholesalers. Averaging across the DSS areas, the proportion of general retailers mentioning at least one of the top three wholesalers was 47%, and of the top five wholesalers, 56%. Although these data do not necessarily reflect the volume of wholesale purchases, they are indicative of high levels of concentration in the wholesale market for general stores.

## Discussion

### Wide availability of drugs

Drugs were very widely available from retail outlets in the study areas. Antipyretics and painkillers could be bought as easily as everyday household items like soap or margarine. Chloroquine was also very easily obtainable, and other antimalarials could be purchased in most minor settlements. By contrast, at the time of the study chloroquine was the only antimalarial in the core drug kit in government primary health care facilities, with a subset of facilities receiving a very limited amount of SP and quinine, and drug stockouts were very common (National Malaria Control Programme 2002).

Two distinct types of retailer stocked drugs. A relatively small number of drug shops generally stocked several different antimalarials and antibiotics, which staff typically travelled long distances to buy from dedicated drugs wholesalers. The much more numerous general retailers, a third of whom stocked chloroquine, nearly always purchased drugs from local general wholesalers.

High use of commercial retailers would be expected among relatively wealthy and urban African populations. However they were clearly an important source even in these very poor and rural areas, despite relatively good health facility coverage by African standards.

### Generalizability of results

Care should be taken in generalizing the results to other settings. First, the DSS areas were not necessarily

representative of their districts as they excluded the towns where district headquarters were located and some of the most remote locations. Secondly, drug stocks may vary seasonally in response to changes in fever incidence, cash availability, access to suppliers, and population movement. Thirdly, stocking patterns may change rapidly over time; follow-up work indicated that by 2001 the availability of SP had increased and chloroquine stocks had been reduced or eliminated (Goodman C, Kachur SP, Abdulla S, Khatib R, Boland P, Mills A, unpublished data). Finally, patchy evidence suggests cross-country variation. In West Africa itinerant vendors were often an important retail supplier of drugs (Van der Geest 1987; Faye *et al.* 1996; Djimde *et al.* 1998) and in coastal Kenya a higher percentage of general retailers stocked antimalarials (73% compared with 33% in this study), perhaps due to the absence of drug stores in those rural areas (Molyneux *et al.* 1999).

### Implications of retail drug provision – the risks

Chloroquine was widely available at the time of the study, indicating sustained demand despite high levels of treatment failure due to drug resistance (28–72% of young children in Tanzanian sentinel sites in 1997–99) (Ministry of Health 1999). This implies that a high proportion of patients received an ineffective drug. Factors underlying persistent chloroquine demand may include its low price, lack of knowledge of alternatives, lack of recognition of treatment failure, the role of patient immunity, and chloroquine's antipyretic action. Branded products made up three quarters of available chloroquine and amodiaquine tablet products, and over 90% of SP products, indicating frequent use of non-generic drugs, and higher costs for consumers. The sheer number of brands is likely to have confused both retail staff and consumers.

We found considerable illegal stocks of antimalarials, antibiotics and injectable drugs in drug stores, indicating weak regulation. These stocks provided the community with a readily accessible source of medicines, which must be balanced against the possible risks of inappropriate drug choice and dosing, adverse drug reactions, and inadequate follow-up. Moreover, the illegal aspects of their operation may compromise the potential for public–private

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collaboration, as government authorities cannot openly collaborate with retailers engaged in an illegal activity.

There are important implications for the implementation of combination therapy. SP and amodiaquine, both components of potential combination regimens, were easily available as monotherapies, although prior to the national change in first-line antimalarial, only from a limited number of drug shops. While artemisinin drugs were very rarely seen, a substantial fall in their retail price would be likely to lead them to be stocked by many more rural shops. Widespread availability of these components as monotherapy may compromise their efficacy within a combined treatment (White 1999).

**Implications of retail drug provision – the opportunities**

Retail drug provision should not be seen purely as a problem; it also provides opportunities for improving malaria treatment, acting as an effective drug distribution channel to remote, rural areas. Population ratios in the DSS areas clearly indicate the relative accessibility of retail drug providers, and of general stores in particular. There was one retailer stocking drugs for every 310 people, and one antimalarial retailer for every 834 people, compared with one health facility for every 4368. Other studies have documented additional advantages of retail outlets including speed of service, better drug availability and convenience of operating times (Van der Geest 1987; Snow *et al.* 1992; Ndyomugenyi *et al.* 1998; Molyneux *et al.* 1999).

Interest is growing in interventions to improve retail sector quality such as provider training, accreditation, consumer education, pre-packaging of drugs, and strengthening of regulatory systems (Mills *et al.* 2002). This study suggests that interventions targeted at all drug retailers are likely to be costly to deliver and difficult to sustain given the sheer number and heterogeneity of shops, and the difficulty of documenting all outlets in the absence of a strong research infrastructure. Moreover follow-up work in the study sites has demonstrated a very high turnover in general shops, with less than two-thirds still operating and selling drugs after 1 year (Goodman *et al.*, unpublished data). These practical difficulties, combined with the challenge of designing interventions that are compatible with shopkeeper incentives, suggest that retail quality may more cost-effectively be improved by shaping demand through consumer education, and modifying the chemical quality, packaging and price of products entering the retail distribution chain (Battersby *et al.* 2003).

However this study also identifies two important entry points where intervention may be feasible at the level of the rural shop. First, drug shops are relatively few in number

and an established supplier of antimalarials. Their staff have primary education and some health-related training which could be built upon through targeted educational strategies. Secondly, as the majority of general retailers use a relatively small number of wholesale outlets, the retail level could be influenced by interventions targeted at the most frequently used general wholesalers. Strategies targeting drug shops and the most frequently used wholesalers could involve a mixture of training, provision of job aids and regulatory strengthening (Marsh *et al.* 1999; Stenson *et al.* 2001; Tavrow *et al.* 2003). The effectiveness of all interventions based around these outlets will be maximized if they involve both the suppliers and their customers. However, as Tanzania has over 6000 Part II drug stores in total, the feasibility of scaling up to national level must be carefully considered even with such a targeted approach.

Malaria treatment policy in Africa has focused mainly on the government health system, at most including formal private facilities. We demonstrated the importance of acknowledging the reality of widespread retail provision, and identified points for intervention. These may enable policy makers to take advantage of the opportunities provided by the retail sector, while acting to contain those behaviours that pose risks for today's patients, and through their impact on drug resistance, for the patients of the future.

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