In-home drug storage and utilization habits: a Sudanese study

M.A. Yousif[1]

عادات تخزين الأدوية داخل المنزل واستعمالها. دراسة سودانية

ميرغني عبد الرحمن يوسف

الخلاصة: تمت دراسة عادات استخدام الأدوية في المجتمع في 469 وحدة سكنية من مختلف مناطق السودان. وقد وُجد أن 97.7٪ من الأسر المدروسة لديها منتج دوائي واحد على الأقل مخزون في المنزل. وأوضحت الدراسة المعدل المرتفع للتطبيب الذاتي (46.9٪) والاستخدام المتكرر للأدوية المختزنة التي لم تنضب (55.0٪)، ومعدلاً مرتفعاً لتبادل الأدوية بين الأسر (59.3٪) وسوء الامتثال (71.2٪). وتمس الحاجة في السودان لتحفيز عامة الناس لتطبيق مبادئ الاستخدام الرشيد للأدوية ولحماية صحتهم وتجنُّب الخسارة الاقتصادية.

ABSTRACT Community drug-use habits were studied in 469 household units in different areas of Sudan. About 97.7% of the investigated families had at least one drug product stored at home. The study revealed a high rate of self-medication (46.9%), repeated use of unfinished stored drugs (55.0%), a high rate of drug exchange among families (59.3%) and poor compliance (71.2%). In Sudan there is still a great need to educate and to motivate the general public regarding the principles of rational drug use in order to safeguard health and avoid economic losses.

Les médicaments conservés à domicile et les habitudes d'utilisation : étude au Soudan

RESUME Les habitudes communautaires de consommation des médicaments ont été étudiées chez 469 ménages de différentes zones du Soudan. Environ 97,7 % des familles examinées avaient au minimum un produit pharmaceutique conservé à domicile. L'étude a révélé un taux élevé d'automédication (46,9 %), l'utilisation répétée de médicaments non finis conservés (55,0 %), un taux élevé d'échange de médicaments entre les familles (59,3 %) et une mauvaise observance (71,2 %). Au Soudan, il demeure important d'éduquer et de motiver le grand public en ce qui concerne les principes de l'usage rationnel des médicaments afin de protéger la santé et d'éviter des pertes économiques.

[1]*Faculty of Pharmacy, University of Gezira, Wad Medani, Sudan.*

Received: 22/02/01; accepted: 12/08/01

Introduction

There is a steady worldwide increase in drug consumption, resulting from patterns of increased prescribing, dispensing and use of medicines. Taking drugs at home without prescription has become a habit that is often encouraged in the community. Some patients do not comply with the exact duration of prescriptions, perhaps because of inadequate communication to patients by health workers [*1,2*]. This frequently leads to the incomplete consumption of prescribed and dispensed medicines. Iguna explored the influence of relatives and friends who constitute the social network that significantly impacts decisions to seek treatment [*3*]. Drugs may be taken without real need. The easy access to home-stocked medicines enables a high consumption rate of medicines for self-limiting diseases. Haak and Hardon examined pharmaceutical use in a rural population and found that between one-half and two-thirds of the medicines used were used irrationally from a biomedical viewpoint. Furthermore, one-third was potentially dangerous [*4*]. There was little awareness of possible hazards from modern medicines and the general view was that they should be used for any sickness or discomfort. The inappropriate use of drugs may result in wastage of resources, increased resistance of pathogens, serious health hazards, adverse reactions and prolonged suffering [*5*].

Thus the present study aimed to investigate the prevalence of household drugs and identify community drug-use habits in different areas of Sudan.

Methods

The study took place during January and February 1998 as part of the assigned training programme for the final-year students of the Faculty of Pharmacy, University of Gezira, Wad Medani, Sudan. The students were thoroughly briefed on the objectives of the study and clearly instructed about where, how and when to collect data effectively and how to complete a pre-tested questionnaire properly. The students were advised to obtain data from their own residences as well as from the neighbours who lived to the back, front, right and left of their homes.

The household unit was defined as the room or group of rooms occupied by one family living apart from others in separate quarters. A household was defined as the people who resided in a housing unit at the time the interviewer was speaking to a household member. The household also included people absent at the time of contact if a place of residence was held for them and no place of residence was held for them elsewhere. A family unit consisted of household members who were related to each other by blood or marriage [*6*].

The heads of the households, their spouses or any other members who took care of health affairs within the family were interviewed using the first part of the questionnaire to identify the following:

- Education of the head of the household unit;
- Whether and why they were keeping drugs at homes;
- Where and for how long they stored these drugs;
- If any one of the family fell sick, whether she or he consulted a doctor or directly used the stored drugs;
- If they normally completed the doctor's prescribed dose;
- Whether they exchanged drugs among the family members, their relatives, friends and neighbours; and,

- If, when they had the same symptoms for which they had been treated before, they used the same drugs to treat the same symptoms or preferred to consult a doctor.

The students requested the heads of the household units to guide them to different storage places of the pharmaceuticals in the premises. The following indices of each stored drug were recorded: the unit dosage form; the storage conditions and storage places; the dispensing date; whether the drug was in current use or stored for future use; the dispensing type; the dispensing place; the remaining unused quantity; and the expiry date. The following information on stored reconstituted antibiotic oral powders was recorded: the reconstitution date; the type of reconstitution vehicle; the individual who carried out the reconstitution; and the remaining amount of the stored drug.

Descriptive and cross analysis for different variables was performed. The data were tabulated and processed with *SPSS*.

Results

A total of 469 household units were surveyed during January and February 1998 in different parts of Sudan to investigate common in-home drug storage and use. All the heads of these families or their spouses were interviewed. Altogether there were 2079 stored preparations.

Table 1 shows the number of households according to the number of drugs stored. The mean number of drugs per household unit was 4.4 and the range was 0–18. At the time of the study, 458 (97.7%) had at least one drug preparation in storage. In the 11 (2.3%) household units with no stored items, the interviewees stated that they comply with the prescribed quantities

Table 1 **Number households by number of preparations stored**

No. of drugs stored	No. of households (n = 469)	%
0	11	2.3
1	33	11.3
2	63	21.6
3	90	30.9
4	54	18.6
5	51	17.5
6	42	9.0
7	20	6.2
8	35	7.5
9–18	61	13.0

The mean number of drugs stored per household = 4.4.
There were a total of 2079 stored products.

or disposed of surplus medicines, either by donation to relatives, neighbours or friends, or by disposing of the drug on expiry.

In response to whether they used the stored drugs prior to consulting a doctor, 46.9% used the stored drugs before visiting doctors, while the others used them after a doctor's consultation (Table 2). When asked whether they completed the prescribed dose after consulting the doctor, 28.8% said they did not. Also, 55.0% repeatedly used partially consumed stored drugs to treat the same symptoms upon reoccurrence without consulting a doctor. In response to whether they exchanged stored pharmaceuticals among their relatives, friends and neighbours, 59.3% said they did (Table 2).

Of the in-home stored drugs, 500 items were analysed in order to gather data about type of drug, form of drug, and how these drugs were prescribed, dispensed, used

Table 2 **Drug use habits of participants**

Use	No. (n = 469)	%
When taken		
Prior to doctor consultations	220	46.9
After doctor consultations	249	53.1
Completes regimen		
Yes	334	71.2
No	135	28.8
Exchanges medicines		
Yes	278	59.3
No	191	40.7

Table 3 **Data on drugs stored**

Data	No. (n = 500)	%
Type of drug		
Antibiotic	110	22.0
Analgesic	59	11.8
Anti-malarial	52	10.4
Miscellaneous	279	55.8
Form of drug		
Tablets	220	44.0
Syrups	176	35.2
Capsules	42	8.4
Topical preparations	37	7.4
Injectable formulae	22	4.4
Suppositories	3	0.6
Storage conditions		
Appropriate[a]	256	51.2
Inappropriate	244	48.8
Usage		
In current use	264	52.8
For future use	236	47.2
Type of delivery		
Rational[b]	354	70.8
Irrational	146	29.2
Source of drugs		
Pharmacy	465	93.0
Abroad	28	5.6
Other stores	7	1.4
Amount of drug used		
None	94	18.8
Partially used	406	81.2
Expiry status		
Expired	76	15.2
Not expired	409	81.8
Not known	15	3.0

[a] *An appropriate storage condition was defined as keeping the medicines under refrigeration or exposed to a ventilated area and out of the reach of children.*

[b] *Items obtained through a doctor's consultation and proper dispensing were considered rationally delivered items.*

and stored in homes (Table 3). Descriptive and bivariate analyses for different variables were performed. Two types of storage conditions were evaluated. An appropriate storage condition was defined as keeping the medicines under refrigeration or exposed to a ventilated area and away from the reach of children. Inappropriate storage conditions were defined as storage conditions in which the above measures were not carefully followed (Table 3).

The means by which these items were obtained were classified into two types. Items obtained through an appropriate delivery system, i.e. through a doctor's consultation and proper dispensing, were termed rationally delivered items. All others were designated as irrationally delivered items (Table 3).

Only 30 (6.0%) of the items stored were reconstituted oral antibiotic powders. Table 4 gives information on the reconstitution of these antibiotic preparations. Of the antibiotics stored, the beta-lactam antibiotics of penicillin and cephalosporin derivatives constituted 41.8% (46), co-trimoxazole constituted 13.6% (15), tetracycline derivatives constituted 10.0% (11) and

Table 4 **Data on reconstituted oral antibiotics**

Data	No. (n = 30)	%
Reconstitution status		
Intact	4	13.3
Freshly reconstituted and still valid	14	46.7
Gone past the validity of reconstitution	12	40.0
Reconstitution fluids		
Appropriate (distilled water)	3	10.0
Inappropriate	27	90.0
Reconstituter		
Parent	28	93.3
Pharmacy personnel	2	6.7

erythromycin and antituberculous drugs constituted 5.5% (6) and 0.9% (1) respectively. Other home-stored miscellaneous antibiotics constituted 28.2% (31). Of the analgesics stored, paracetamol was the most common (49, 83.1%), followed by acetyl salicylic acid (10, 16.9%).

Bivariate analysis

When dose compliance was related to the quantity of drugs stored in the home, 28 (82.4%) of the household units storing only one drug were complying with the prescribed dose. Of those who had 1–4 stocked items, 182 (75.8%) had complied with the prescribed dose. Compliance was inversely proportional to the number of stored items: 119 (67.2%) for those with 5–9 drugs and 25 (65.8%) for those with 10–14 drugs. Thus, the number of stored drugs indicated lack of compliance with prescribed drug intake.

When comparing level of education to drug intake compliance, illiterate respondents had the lowest compliance rate (16, 59.3%), followed by those with intermediate education (127, 69.8%) and university graduates (93, 72.1%).

Of those who completed prescribed dosages, 175 (52.4%) did not use stored drugs to treat the same symptoms before consulting a doctor, but only 36 (26.7%) of those who did not complete prescribed dosages did the same. There was a highly significant difference between those who took drugs to treat same symptoms and those who did not ($P < 0.001$).

When drug exchange patterns were correlated to the size of the family, 150 (60.0%) families with 2–6 members, 112 (58.0%) with 7–11 members and 15 (57.7%) with 12–16 members exchanged drugs among themselves. A very high rate of drug exchange was observed among families who directly used stored drugs to treat the same symptoms as compared to those families who did not. Of the families who directly used stored drugs to treat the same symptoms, 186 (66.9%) exchanged stored medicines between themselves, while only 72 (37.1%) of those who did not use stored drugs to treat the same symptoms did the same; the difference was significant ($P < 0.001$).

When patterns of exchanging home stored drugs between the respondents were cross-tabulated with level of education, a higher exchange rate (19, 70.4%) was observed for those who had not had any education (Table 5).

There was a relationship between the interviewee level of education and the number of stored drugs. Of the 11 (2.3%) who did not store medicines in the home, 6 (54.5%) were university educated, 4 (36.4%) were secondary educated and 1 (9.1%) was primary educated. All illiterate respondents (27, 5.8%) had at least one product in their homes at the time of the study.

Table 5 **Level of education according to the exchange of drugs and in-home drug use habits**

Education level	Patients who exchanged drugs			Patients who did not exchange drugs		
	No.	%[a]	%[b]	No.	%[a]	%[b]
Illiterate	19	70.4	6.8	8.0	29.6	4.2
Primary	85	64.9	30.6	46	35.1	24.1
Intermediate	101	55.5	36.3	81	44.5	42.4
University	73	56.6	26.3	56	43.4	29.3
Total	278	59.3	100.0	191	40.7	100.0

[a]*Percentage of the education variable;* [b]*percentages of the total.*

As for the prevalence of home-stored drugs according to education level, interviewees with secondary education had the greatest number of drugs (862, 38.1%) followed by primary education (647, 28.6%), university education (638, 28.2%) and illiterate (116, 5.1%). University-educated respondents had the largest mean number of stored drugs (5.0) while illiterate respondents had the lowest mean (4.3).

The highest rate of drug storage (527, 59.3%) was observed in the homes of families who exchanged medicines among themselves prior to any medical advice. The mean number of stored drugs was inversely proportional to the size of the family (3.6 for families with 2–6 members, 2.5 with 7–11 members and 2.2 with 12–16 members). The highest observed mean of home-stored medicines was 4.1 for a couple living alone.

Most of the items in current use were obtained through prescriptions (195, 73.9%), and only 69 (26.1%) were obtained by self-medication. Of the items kept for future use, 159 (67.4%) were prescribed by doctors and only 77 (32.6%) were obtained through self-medication (Table 6). Table 6 also shows the forms of the drugs in current use and those kept for future use.

As for the relationship between the dispensed form of the stored drug and the dispensing outlet, 175 (89.7%) tablet preparations were collected from licensed pharmacy outlets, 8 (4.1%) tablet preparations were received from abroad and 6

Table 6 **Prescription and form of the drugs analysed according to use status**

Data	In current use		Stored for future use	
	No.	%	No.	%
How prescribed				
Physician prescribed	195	73.9	159	67.4
Self prescribed	69	26.1	77	32.6
Form of drug				
Tablets	108	40.9	87	36.9
Syrups	86	32.6	90	38.1
Capsules	24	9.1	18	7.6
Injectable formulae	16	6.1	6	2.5
Topical preparations	14	5.3	23	9.8
Eye drops	13	4.9	8	3.4
Inhalers	3	1.1	1	0.4
Suppositories	–	–	3	1.3

(3.1%), 5 (2.6%) and 1 (0.5%) were obtained respectively through exchange between friends, other stores and relatives.

Expiry date was cross-tabulated with the form of the stored drugs and the results are given in Table 7. Of the valid stored preparations, 77 (18.8%) were found in complete and intact packages, while only 15 expired items (19.7%) were found in complete packs; 61 expired drugs (80.3%) were partially used. Of the stored products of unknown validity 2 (13.3%) were in full packs and 13 (86.7%) were partially used. In addition, 42 (55.3%) of the expired items were not properly stored.

Discussion

Household units with no drugs comprised only 2.3% of the investigated households compared to 47.5% in a similar study in Papua New Guinea [5]. This difference can be attributed to the applied policy of essential drugs in Papua New Guinea. The number of home-stored medicines in the present study ranged from 0 to 18 items, which was similar to the Papua New Guinea study. The mean number of drugs stored per household unit, however, was very high at 4.4 products per household unit, compared to 2.4 in the Papua New Guinea study. This may indicate a significant lack of compliance or a high morbidity rate.

Storage conditions were judged suitable if integrity, purity, stability and hazard avoidance of the preparation in question could reasonably be guaranteed. Instances of unsuitability mostly involved liquid preparations stored on open shelves, and reconstituted oral antibiotic powders stored for more than the recommended period after reconstitution or kept at freezing point. The rate of unsuitable storage conditions in our study was 26.0%, compared to 31.8% in the Papua New Guinea study [5]. There was a higher rate of inappropriate storage in rural areas due to the lack of refrigeration. Liquid formulations generally tend to have much shorter shelf-lives than solid formulations and once opened should be used within 2 weeks to avoid any microbial contamination or reduction in activity. The nature of syrup formulations in terms of added adjuncts such as sweetening, flavouring, and suspending, stabilizing and preserving agents makes the liquid formula a complex one that is very prone to physical, chemical and microbiological instability.

In response to whether the households used the stored drugs prior to doctor consultations, a very high rate of self-medication was found (46.9%). It was surprising that in 28.8% of the prescribed drugs, patients deliberately stopped before completing the prescribers' instructed regimens. Common reasons given were:

Table 7 **Validity status of the home-stored drugs according to form of the drug**

Validity status	No.	%
Tablets		
Valid	161	82.6
Expired	26	13.3
Unknown	8	4.1
Syrups		
Valid	145	82.4
Expired	26	14.8
Unknown	5	22.8
Capsules		
Valid	32	76.2
Expired	10	23.8
Unknown	0	0
Injectable formulae		
Valid	17	77.3
Expired	5	22.7
Unknown	0	0

- There is no need to complete the course after recovery and it is better to keep the rest as it may be needed to treat the same disease or to be given to one of the relatives or neighbours because drugs are very expensive.
- It is a good idea to keep cough syrups in store to treat other children.
- For some drugs, such as those used for headache and fever, there is no need to continue taking the drugs if you become well.

There were numerous indications of inappropriate self-medication and poor compliance with prescribed medications. This was very clear among those respondents (55.0%) who repeatedly used partially consumed drugs without medical consultation and among those who freely exchanged incomplete remaining quantities (59.3%). The possibility for irrational use was considerable.

The prevalence of stored syrup preparations may be explained by poor compliance, especially among children treated with the bitter-tasting chloroquine syrup. The least commonly stored form of drug was the suppository formulation (0.6%), possibly because it was the drug form least used.

Medicines stored for future use comprised 47.2% of the total stored medicines. In the study in Papua New Guinea [5], the rate was 36.9%. Of the stored medicines, 81.2% were partially used, 15.2% had expired and 3.0% had no expiry label attached. This indicated a higher storage rate of medicines of incomplete quantities, badly stored medicines or physically and chemically affected medicines. The easy access to this stock increases the risk of irrational use and promotes such use through the traditional distribution of home-stored pharmaceuticals in the community.

We found that 93.0% of the stored drugs were obtained from official and licensed pharmacy outlets. This rate of rational drug delivery from the official sector could be considered as one of the best in the region compared with a similar study [7].

The high percentage of non-qualified reconstituters led to a high selection rate of unsuitable reconstitution vehicles as well as the addition of improper volumes of the reconstitution vehicle. This resulted in therapeutically inactive or toxic preparations.

The prevalence of antimicrobial agents in this study (22.0%) indicates the high rate of consumption of this group of drugs. These results conform with the study of Sekhar et al. [8].

The level of education had an influence on patient compliance. Illiterate patients had the lowest compliance rate (59.3%). The best compliance rate was observed for patients with university education (72.1%). Future attempts to improve patient compliance should consider these factors. Care should be focused on less educated patients in any community-oriented type of rational drug-intake education. Patients who did not use drugs prior to doctor visits complied more with the regimen (52.4%) compared with the compliance rate (26.7%) of patients who took medicines prior to doctor visits. This irrationality explained the higher rate of drug exchange (66.9%) among families who commonly used their home-stored drugs without doctor consultations compared with the lower rate of exchange among families who did not use home-stored drugs before doctor consultations (37.1%).

The higher exchange rate (70.4%) of home-stored drugs among the illiterate participants reflected the influence of socio-economic factors. These patients usually lived together in villages or densely popu-

lated areas, sharing commodities between themselves as a traditional and common social practice.

The effect of level of education on in-home drug storage was demonstrated by the relative higher rate of university-educated patients who did not store drugs at home (54.5%) whereas all illiterate participants had drugs stored for future use. However, university graduates had the highest number of stored preparations and this may reflect the relative higher purchasing power and greater dependence rate upon Western medications in this group.

An unexpected finding was that the mean number of stored drugs was inversely proportional to the family size. This may be due to the greater use of stocked drugs among large families, to the higher rate of exchange among large families or to financial reasons, since large families tend to be burdened with other expenditures for other commodities.

All of the various unit dosage forms had similar rates of expiry. The highest validity rate was for tablets (82.6%). Similarly tablets had the highest consumption rate, perhaps because of the popular acceptance of the tablet as an easily taken and well tolerated type of medicine. Tablets were also the most common formula type to be without a known expiry date (53.3%), perhaps because of the practice of dispensing unlabelled loose packs allowing for the mixing of drugs during stocking. This is one of the main drawbacks of loose tablets or capsule packs.

Even though there was a traditional community belief in the superior activity of injectable drugs, there was a high rate of storage of such drugs (22.7%), This was perhaps due to the accompanying cost of administration of this form compared to the easy and safe intake of the tablet form. The absence of injectable formulae with unknown validity was mainly due to the effective labelling inscribed on every single dose.

Of the valid preparations, 18.8% were stocked intact; this means that 81.2% had been partially used and thus had a greater potential for misuse. Furthermore, 80.3% of the expired stocked items were partially used. The combined effects of the physical, chemical and microbiological instability of the home-stored drugs together with the fact that 55.3% of expired items were not properly stored collectively add up to increased health hazards.

The proper storage conditions of freshly reconstituted antibiotic oral powders (83.3%) as compared to the relatively lower rate of proper storage of old reconstituted ones (67.7%) indicated a need to educate people to follow instructions and to avoid reusing any reconstituted oral antibiotic powders beyond the recommended time.

Parents and pharmacy personnel shared the responsibility of using inappropriate types of reconstitution vehicles. The enhanced degradation rate and the resulting drop of activity caused by the different metal contents of unsuitable reconstitution vehicles have been previously reported [9].

In Sudan there is still a great need to educate and motivate the general public regarding the proper application of the principles of rational drug use from both the health and economic perspective.

References

1. Biddulph J et al. Compliance of children with tuberculosis treated by short-course intensive chemotherapy. *Papua and New Guinea medical journal*, 1987, 30:159–64.

2. Kiyingi KS, Sime L. Compliance profiles of pediatric patients in an outpatient department. *Papua and New Guinea medical journal*, 1992, 35:95–100.

3. Igun UA. Why we seek treatment here: retail pharmacy and clinical practice in Maiduguri, Nigeria. *Social science and medicine*, 1987, 24(8):689–95.

4. Haak H, Hardon AP. Indigenised pharmaceuticals in developing countries: widely used, widely neglected. *Lancet*, 1988, 2(8611):620–1.

5. Kiyingi KS, Lauwo JAK. Drugs in the home: danger and waste. *World health forum*, 1993, 14(4):381–4.

6. *Interviewer's manual.* Ann Arbor, Michigan, Survey Research Center, Institute for Social Research, University of Michigan, 1976:39, 91, 94.

7. Foster SD. Pricing, distribution and use of antimalarial drugs. *Bulletin of the World Health Organization*, 1991, 69(3):349–63.

8. Sekhar C, Raina PK, Pillai GK. Some aspects of drug use in Ethiopia. *Tropical doctor*, 1981, 11:116–8.

9. Beard SJ et al. Metal ion-catalyzed hydrolysis of ampicillin in microbiological growth media. *FEMS microbiology letters*, 1992, 75:2–3, 207–11.

First global reference guide on safe and effective use of essential medicines

In its efforts to promote safe and cost-effective use of medicines, the World Health Organization released the first edition of the WHO Model Formulary in 2002. The formulary gives comprehensive information on all 325 medicines contained in the WHO Model List of Essential Drugs. It presents information on the recommended use, dosage, adverse effects, contra-indications and warnings of these medicines. Correct use of this tool will improve patient safety and limit superfluous medical spending. The new formulary is primarily intended as a model for national governments and institutions, to be used as a basis for developing their own national formularies. It is particularly relevant for developing countries, where commercial and promotional materials are often the only available source of drug information to health workers, prescribers and patients. The formulary aims to provide unbiased information about medicines based solely on scientific evidence. The WHO Model Formulary is available on the internet at: www.who.int/medicines. A CD-ROM version is also available.