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Prescription habits of dispensing and non-dispensing doctors in Zimbabwe

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The number of dispensing doctors has increased in the last decade, but the implication of this trend on the quality of health care and drug use is unknown. We present a comparative drug utilization study of 29 dispensing doctors and 28 non-dispensing doctors in Zimbabwe based on standard indicators developed by the World Health Organization.

Dispensing doctors prescribed significantly more drugs per patient than non-dispensing doctors (2.3 versus 1.7), injected more patients (28.4% versus 9.5%), and prescribed more antibiotics (0.72 versus 0.54) and mixtures (0.43 versus 0.25) per encounter. Dispensing doctors also spent significantly less time on each encounter (8.7 min versus 13.0 min) than their non-dispensing colleagues. The use of generic name, brand name and essential drugs did not differ significantly between the two groups of practitioners. Multivariate analyses controlling for gender, race, place of education, location of practice and patients seen per day showed that dispensing by doctors was associated with less clinically and economically appropriate prescribing. These findings suggest that the quality of health care – as related to drug use, patient safety and treatment cost – is lower with dispensing doctors than with non-dispensing doctors.

Key words: prescribing, quality of care, private practitioners, Zimbabwe

Introduction

A dispensing doctor (DD) is defined as a medical practitioner permitted to sell and dispense a drug to some or all of his patients, either as an exemption to the general legislation governing the provision of pharmaceutical services or as part of the overall provision of medical services (Abood 1989; Axon 1994; Truter et al. 1995).

The number of DDs has increased in several countries. In South Africa the number has doubled from about 4000 in 1985 to almost 8500 in 1995 (*Pharmacia* 1996). In the UK the number has increased from 12% in 1967 to 15% in 1993 (Clothier 1977; Morton-Jones 1993; Ryan and Bond 1996). In the USA between 5 and 9% of all general practitioners were licensed as dispensing doctors in 1990–91 (Glassman 1987; Abood 1989). In Asian countries, doctors in general practice normally dispense drugs, whereas specialists only prescribe (Glassman 1987; Kapil 1988; Nizami et al. 1996). In other countries, such as in Scandinavia, doctors are not allowed to sell and dispense medicine concurrently.

Little is known about the implications of dispensing by doctors on the rationality[1] of drug use and quality of care. Very few studies have evaluated the prescription habits of DDs (Kapil 1988; Stewart-Brown 1995; Truter et al. 1995; Fouri 1996; Nizami et al. 1996) and we have found these studies inappropriate for making reliable comparisons between the practices of DDs and non-dispensing doctors (NDDs). The purpose of this study is to describe and assess drug prescription by DDs in comparison with NDDs.

Methods

Design

The study is an observational cohort study evaluating drug utilization of private sector DDs compared with NDDs. The study applies the World Health Organization (WHO) prescribing indicators (Fouri 1996) using retrospective data from patient records as recorded in connection with the patient's most recent visit to the practice. For comparative studies, the WHO method recommends inclusion of 20 randomly selected practices, with 30 randomly selected patient encounters per practice (Hogerzeil et al. 1993; WHO 1993).[2]

Setting

The capital of Zimbabwe, Harare, was selected as the study area. The selection of Harare ensures the presence of a pharmacy in the neighbourhood of any DD and thus easy access to both types of practices.

Sample

Of the approximately 150 DDs registered in Harare, 20% were included in the study.[3] The practices of 50 NDDs and 48 DDs were sampled from the Ministry of Health's lists of licensed DD and NDD practices using systematic random sampling as described in the WHO manual on investigating drug use (Hogerzeil et al. 1993; WHO 1993). It could be expected that some NDDs would be classified as DDs and thus more NDD practices were selected. The practices were contacted for participation in the study by telephone, or by letter if no telephone was available. Twenty-nine DDs and 28 NDDs from the selected practices agreed to be included in the study. Twelve NDDs and ten DDs were not accessible, as the registers used were not up-to-date. Other reasons given by doctors for not wanting to participate included: owner retired or about to retire, lack of necessary authority to agree to inclusion, patient protection, partner of an already selected facility, recently specialized, only in practice for 1 month, daily opening hours very limited or not interested. Moreover, it is assumed that some practices did not want to participate because they dispensed drugs without the necessary licence. These factors resulted in the inclusion of 76% of the selected and reachable DD practices and 74% of the selected and reachable NDD practices in the study.

Prescription indicators

A standard set of drug prescription indicators developed by the International Network for Rational Use of Drugs (INRUD) and WHO was used to compare prescribing and to assess the problems of clinically or economically inappropriate drug use (Hogerzeil et al. 1993; WHO 1993). The indicators included in the study are listed in Table 1. Calculation of the indicators is carried out in accordance with the procedures described in the WHO/INRUD manual on investigating drug use (WHO 1993).

The selected drug use indicators are used in accordance with WHO guidelines and have been applied in numerous studies in Zimbabwe (Lessing and Trap 1995; Ministry of Health 1993, 1995, 1996). Pilot testing that encompassed the training of data collectors and revision of data collection tools was undertaken prior to the start of the study to ensure uniform data collection.

Average consultation time was measured for 10 patients from the time the patient entered the consultation room until leaving the room. This observation was made without the doctor's knowledge. Thus consultation time included dispensing when undertaken in the consultation room. If fewer than 10 patients were seen during data collection or due to closing the practice for the day, the consultation time was calculated on the number of patients seen in the recorded working period.

The indicators do not measure the adequacy of the diagnoses or appropriateness of the treatment in relation to the diagnoses. However, the indicators may be used to assess clinically or economically inappropriate drug use by measuring the number of drugs, generic prescriptions, injections, antibiotics and mixtures[4] prescribed per patient. The value of this information is reinforced by comparison.

In the study, essential drugs were defined as drugs included in the Zimbabwe essential drugs list, 1994 edition, containing about 550 drugs (Nazerali and Levy 1994).

Table 1. Comparison of dispensing and non-dispensing doctors using drug use indicators for evaluation

WHO/INRUD rational drug use indicators	Dispensing doctors (n = 29) n (95% CI)	Non-dispensing doctors (n = 28) n (95% CI)	Student's t-test[a]
Drug use			
Average number of drugs per encounter[b]	2.3 (2.1–2.6)	1.7 (1.5–2.0)	p = 0.0001
Injection use			
% of encounters with ≥1 injections prescribed	28.4 (18.9–37.9)	9.5 (3.8–15.2)	p = 0.002
Average number of injections per encounter	0.30 (0.20–0.41)	0.10 (0.04–0.15)	p = 0.002
Injections as % of drugs prescribed	13.1 (8.1–18.2)	5.4 (2.1–8.7)	p = 0.016
Antibiotic use[c]			
% of encounters with ≥1 antibiotics prescribed	58.0 (52.1–63.9)	47.9 (42.0–53.8)	p = 0.02
Average number of antibiotics per encounter	0.72 (0.62–0.83)	0.54 (0.46–0.61)	p = 0.006
Antibiotics as % of drugs prescribed	31.7	31.8	
Mixture use			
% of encounters with ≥1 mixture prescribed	27.1 (21.9–32.3)	19.0 (14.8–23.1)	p = 0.02
Average number of mixtures per encounter	0.43 (0.33–0.53)	0.25 (0.19–0.31)	p = 0.005
Mixtures as % of drugs prescribed	17.8	14.3	
Other indicators			
% of drugs prescribed by generic name	43.7	43.6	
% of drugs prescribed from essential drugs list[d]	73.0	68.3	
Average number of visits per patient per year	3.83	3.11	
Consultation time (in minutes)	8.7 (7.1–10.2)	13.0 (11.4–14.6)	p = 0.005

[a] Two-sample, two-tailed, separate variance t-test.
[b] A drug use encounter is the period of contact between a patient and a health provider. Ideally, this encounter includes a number of components: history taking; the diagnostic process; selection of pharmacological and non-pharmacological treatment; prescription (and perhaps dispensing) of treatment; and explanations about treatment, follow-up and prevention.
[c] The classification of antibiotics as given in the WHO manual is used including antibiotic creams, i.e. ointments, antibiotic-containing anti-diarrhoea products, and sulfa drugs, but not including metronidazole and other antiprotozoals.
[d] Nazerali and Levy (1994).

Table 2. Background of dispensing and non-dispensing doctors in the sample (percentage)

Background/predictor variables	Dispensing doctors (n = 29)	Non-dispensing doctors (n = 28)	Student's t-test	χ^2 test
Located in low-density area (%)	48	82	p = 0.007	p = 0.007
Female (%)	3	36	p = 0.001	p = 0.002
Race (%)				
Asian	24	11		
African (black)	69	57		
European	7	32	p = 0.015	p = 0.04
Age in years (%)				
25–35	17	18		
36–45	31	50		
46–55	45	21		
56–65	3.5	7		
≥66	3.5	4	n.s.	n.s.
Years in practice (%)				
0–10	38	32		
11–20	31	36		
≥21	31	32	n.s.	n.s.
Country of education (%)				p = 0.04
Zimbabwe	48	47		
UK	7	21		
Asia	21	0	p = 0.009	
USSR/SA, others	24	32		
Numbers of doctors in the practice (%)			n.s.	n.s.
One doctor only	76	61		
Average number of patients seen per day (%)			p = 0.02	
≤20	10	28		
21–40	48	61		
41–60	21	11		
>60	21	0	p = 0.01	

Data were collected from April through July 1997 by three data collection teams, each surveying between 17 and 21 practices equally distributed between dispensing and non-dispensing doctors. The practices were classified according to their actual – not necessarily licensed – type of practice and high or low urban density. Doctors were interviewed for factual information on gender, age, race, country of education, years in practice, number of practice partners and number of patients seen per day.

All practices had similar administrative practices and both types of practice kept patient records for all patients (walk-in and booking). New records were established for new patients. Most practices kept individual records for children, but a few practices included infants in the mother's record. The number of patient records varied considerably from practice to practice and in relation to the number of patients and partners. Some practices did not remove 'dead' records. Therefore, to ensure the inclusion of 'live' records only, records had to have an entry less than 6 months old.

Systematic random sampling from each practice was used to select 30 patient records from the entire number of patient records on file. The 30 records were divided by the number of boxes, drawers or piles (units) in use, giving the number of records to be selected from each unit. Records were then selected from the series of records in the unit by repeatedly taking one from the beginning, middle and end of the series, continuing across the file drawers when necessary. For example, if two records were to be selected from each unit, they would be taken from the beginning and middle of the first unit, from the end and the beginning of the second unit and so forth. If the record selected had not been used within a 6-month period prior to the survey date, the next record in line would be selected and so forth until a valid record was found. Due to time constraints (office hours) and missing data, only 28 patient records were included from one NDD and only 26–29 records were collected from five DDs. The average number of encounters included was 29.7 for DDs and 29.9 for NDDs.

Data from the patient's last visit were collected from each patient record about the drugs dispensed or prescribed (name and formulation), as well as the total number of visits within the last year.

A Student's t-test and χ^2 test were used to compare predictor variables and the distribution of specific variables between DDs and NDDs. A linear regression analysis was applied to test the influence of predictor variables on the outcomes of the study. The outcome variables included in the test are those listed in Table 1 and found to differ significantly ($p < 0.05$) in the bi-variate analyses between DDs and NDDs. The outcome variables included were use of drugs, injections and antibiotics, as well as mixtures and consultation time. The predictor variables tested were variables included in Table 2 and found to differ significantly between DDs and NDDs in the χ^2 test. To further minimize the number of variables included in the test, each potential confounder was tested one by one for significance against the outcome variables in regression analyses, and confounders with $p < 0.1$ were included for testing. Predictor variables included were gender, race (Caucasian and African), country of education (Asia), localization of the practice and number of patients seen.

Results

The specific findings, 95% CI and p value for each drug use indicator for the DDs and NDDs, respectively, are shown in Table 1. A total of 862 patient records from DDs' practices and 838 from NDDs' practices were included in the study. The average number of visits per patient per year was 3.83 for DDs and 3.11 for NDDs, respectively. The analysis showed that DDs prescribed 37% more drugs per patient, gave injections three times more frequently, provided 33% more antibiotics, prescribed 72% more mixtures per encounter, had much shorter consultation times and treated more patients per day compared with NDDs.

The study found that two DD practices prescribed antibiotics or injections for 87–93% of their patients. Sensitivity analysis after dropping these two practices and re-running the analysis for antibiotic and injection use still resulted in significant differences. No NDD practices had such extreme practices. On average, DDs total average drug use per prescription was more than one-third greater than that of NDDs. Calculated on the average number of visits, the annual number of drugs prescribed was 5.26 per patient for NDDs compared with 8.85 for DDs, or 68% more.

DDs were found to prescribe mixtures more frequently than NDDs – close to every second patient compared with every fourth patient. The prescribing of essential drugs was slightly higher for DDs, but the difference was not found to be significant. There was no significant difference in the use of generic drugs.

The background characteristics of the DDs and NDDs are given in Table 2. Eighty-two per cent of the NDDs were located in the low-density area of Harare, whereas the DDs were distributed evenly between high- and low-density urban areas. Only 3% of DDs were female, compared with 36% of NDDs. There was no significant difference between DDs and NDDs when comparing average age: 44.9 and 43.4 years, respectively.

Black Africans constituted the highest share in both groups and with close to 50% educated in Zimbabwe in both groups. One-third of the NDDs were Caucasian, which was nearly five times higher than for the DDs. There were twice as many Asians in the DD group. The patient load was higher for DDs, with an average of 40 patients per practice per day compared with 26 for NDDs.

The possible effect of predictor variables on the outcomes of the study was evaluated by regression analysis. The results of the regression analyses are presented in Table 3. The regression analysis did not confirm findings from the bivariate analyses on the number of antibiotics per encounter and on consultation time depending on the practice type, but the other findings were confirmed and related to practice type. Predictor variables influencing the findings were location of the practice, place of education, race and number of patients seen per day. Practice type (dispensing or non-dispensing) was found to be a variable explaining differences in prescribing, with DDs prescribing a higher average number of drugs per encounter ($\beta = 0.44$; $p = 0.014$), more encounters with injections ($\beta = 12.93$; $p = 0.047$) and more mixtures per encounter on average ($\beta = 14.78$; $p = 0.050$) compared with NDDs. Longer consultation time was related significantly to race (Caucasian practitioners) ($\beta = -5.15$; $p = 0.01$) and to low localization density ($\beta = -3.26$; $p = 0.01$), but the multivariance analyses including all variables could not confirm relation to dispensing status. A model that included gender, education and race significantly related longer consultation time to NDDs ($\beta = -2.92$; $p = 0.03$). Apart from being related to dispensing status, high injection use was also found to relate to high location density ($\beta = 19.89$; $p = 0.002$) and practices with a heavy daily patient load ($\beta = -23.14$; $p = 0.026$). A high number of drugs prescribed per patient was related to DDs and to practitioners educated in Asian countries ($\beta = -0.70$; $p = 0.020$). A regression analysis including dispensing status, gender, location, education, number of patients seen per day and Caucasian race significantly related a low number of drugs prescribed per patient to Caucasian prescribers ($\beta = 0.41$; $p = 0.048$).

Discussion

Dispensing by doctors has been a topic of lively debate. Discussion has often been related to economic issues focused on competition between pharmacists and doctors, with less attention given to the patient (Glassman 1987; Abood 1989; Axon 1994; Stewart-Brown 1995; Trap 1997; Gilbert 1998). Doctors may dispense drugs for many reasons. Accessibility and availability can play a part, based on factors such as insufficient pharmacy coverage, or the desire to facilitate treatment and compliance by having consultation and drug dispensing in one and the same place. Economic factors such as the desire to increase or sustain the physician's income are another reason. To date the consequences have been difficult to assess, with few studies characterizing or evaluating clinically or economically appropriate drug prescribing. Therefore discussions have been highly normative, value loaded and controversial.

The response rate including non-reachable practices, although under 60%, was equal for DDs and NDDs. Voluntary inclusion may have excluded doctors unsure about the quality of their performance, resulting in better clinically or economically appropriate drug prescribing than is the actual case. This could be expected to affect both types of practice equally. If anything, voluntary inclusion would favour better-performing practices.

Table 3. Regression analysis of dependent variables and predictor variables for 29 dispensing practices (862 patient records) and 28 non-dispensing practices (838 patient records)

	Dependent variables: coefficient (95% CI)				
Predictors	Drug use[a]	Injection use[b]	Antibiotic use[c]	Mixture use[d]	Consultation time[e]
Dispensing (DD)	**0.44 (0.10–0.78)**[f]	**12.93 (0.48–25.38)**	4.63 (–5.88–15.14)	**14.78 (0.08–29.48)**	–1.53 (–3.97–0.90)
Gender	–0.04 (–0.35–0.44)	–3.39 (–17.77–10.99)	–4.11 (–16.25–8.03)	5.02 (–11.96–22.01)	2.09 (–0.75–4.94)
Race (Caucasian, UK)	0.10 (–0.42–0.61)	8.57 (–10.27–27.41)	9.13 (–6.78–25.03)	8.27 (–13.98–30.52)	**–5.15 (–8.87– –1.42)**
Race (African)	–0.39 (–0.80–0.03)	–1.38 (–16.60–13.84)	2.02 (–10.82–14.87)	–11.06 (–29.03–6.91)	–2.99 (–6.05–0.06)
Education (Asia)	**–0.70 (–1.27– –0.13)**	–6.54 (–27.40–14.32)	–1.33 (–18.94–16.28)	–14.42 (–39.05–10.22)	–2.43 (–6.39–1.54)
Location density	–0.11 (–0.44–0.22)	**19.89 (7.87–31.91)**	0.69 (–9.46–10.83)	–5.98 (–20.17–8.21)	**–3.26 (–5.61– –0.90)**
No. of patients	–0.09 (–0.45–0.63)	**–23.14 (–42.94– –3.33)**	7.69 (–9.02–24.40)	1.58 (–21.80–24.96)	–2.27 (–6.00–1.45)
n	57	57	57	57	57

[a] Drug use measured as average number of drugs per encounter.
[b] Injection use measured as percentage of encounters with one or more injections prescribed.
[c] Antibiotic use measured as percentage of encounters with one or more antibiotics prescribed.
[d] Mixture use measured as percentage of encounters with one or more mixtures prescribed.
[e] Consultation time measured in minutes.
[f] Bold, $p < 0.05$.

The sampling method ensured sampling from all records irrespective of the size of the file. No differences in filing system were found for the two types of practices. Therefore, we believe that the sampling method applied was appropriate and ensured representation of all patients of the practice. However, patient comparability was not assessed and possible differences in patient populations seen by DDs and NDDs could present a possible threat to the validity of the study.

The standard set of WHO indicators used in this study offers a method for assessing inappropriate drug use. The strength of the method is in comparative studies or studies measuring changes over time. The findings are not linked to a clinical assessment or to diagnoses, and optimal values for the prescribing indicators are not easily defined, although it has been tried (Hogerzeil et al. 1993). The limitations of the method should be borne in mind when discussing the findings. Therefore, emphasis has been put on comparing the findings for DDs and NDDs rather than discussing the face value of the indicators. Evaluating consultation time in a reproducible and standardized manner was found to be very difficult. The findings must therefore be taken more as an indication of the approximate time spent with each patient.

Although our study does not attempt to explain why the differences between the DDs and NDDs exist, it is interesting to note that DDs had a higher representation of doctors of African or Asian origin and a smaller percentage of Caucasians or those educated in the UK, and hardly any female doctors.

Number of drugs per patient

Our study found that DDs and prescribers with Asian educations prescribe more drugs per patient compared with NDDs and practitioners educated elsewhere. Caucasian practitioners prescribed fewer drugs per patient compared with other practitioners. This finding is similar to that from South Africa, in which the number of drugs prescribed by DDs and NDDs was found to be 2.38 and 1.67, respectively (Fouri 1996; personal communication). Earlier studies in the UK found the use of drugs per year per patient to be 1.2–2.2 drugs or 15–35% higher for DDs than for NDDs (Glassman 1987; Stewart-Brown 1995). This difference is less marked than our findings. A public sector study in Zimbabwe found 1.7 drugs to be prescribed per patient (Ministry of Health 1993, 1995, 1996), corresponding to our findings for NDDs and similar to findings from previous studies based on the WHO rational drug use indicators (1.4–1.7 drugs per prescription) (Walker et al. 1990; Hogerzeil et al. 1993). The reason for the higher prescription rate for DDs is unclear but might be related to symptomatic treatment or profit issues. However, this matter needs further investigation.

Use of generic drugs

The use of generic drugs was found to be similar for DDs and NDDs in the present study, unlike the UK studies that found DDs to prescribe fewer generic drugs (Bradlow 1993; Morton-Jones 1993; Stewart-Brown 1995). Prescribing generic drugs is closely related to affordability and the cost of the drugs. For both types of practices, generic prescribing is the best option for reducing patient drug expenses, as generic drugs are in general cheaper than brand name drugs, and as generic substitution had not been introduced in Zimbabwe at the time of the study. One more reason for similar generic use in the two groups could be that the practitioners educated in Zimbabwe, being about 50% in both groups, have been trained in generic prescribing.

Use of antibiotics

Our study finds the use of antibiotics high in both groups compared with previous studies based on the WHO rational drug use indicators, in which the theoretical use of antibiotics is below 30% (Walker et al. 1990; Hogerzeil et al. 1993). Although DDs were found to have a significantly higher use of antibiotics in the t-test, the difference was not striking. The high use in both groups could be related to morbidity patterns dominated by many infectious diseases, but could also indicate over-prescription of antibiotics. The high use of antibiotics is costly and increases the risk of developing resistant strains if the correct dose and duration of treatment are not prescribed and coupled with good compliance. However, this study did not evaluate the correct use of antibiotics or assess the prescribing of antibiotics in relation to the diagnoses, and further investigation is needed to assess clinical appropriateness.

Use of injections

The DDs' use of injections was significantly higher in comparison with NDDs, which was found to be similar to that of the public sector in Zimbabwe, 11% of all encounters (Ministry of Health 1993, 1995, 1996). A Pakistan study assessing treatment of childhood diarrhoea found that DDs injected 15% of patients and prescribed anti-bacterials to 66% of their patients compared with 8 and 50%, respectively, for NDD paediatricians (Nizami et al. 1996). A comparison between this study and ours is difficult due to differences in design and comparison between specialists and general practitioners, but the higher use of injections and antibiotics for DDs is confirmed in both studies. Our study also found the high use of injections to be related to practices situated in high-density areas and practices with a heavy patient load. The reasons for this were not investigated.

High injection use has considerable cost implications along with an increased risk of contamination with blood-borne diseases. This is particularly problematic in a country like Zimbabwe, which has a very high incidence of HIV infection. For antibiotics, high injection use combined with repeated injections can result in poor compliance, which not only has an impact on treatment outcome, but on the development of resistant strains as well. However, this study does not clarify if repeated doses are prescribed and further studies would be needed to clarify this issue.

Use of mixtures

DDs were found to prescribe mixtures to more of their patients as well as more mixtures to each of these patients. In our study, the higher use of mixtures by DDs could not be justified by differences in the percentage of children assessed by similar age groupings for patients prescribed cotrimoxazole (data not shown). The high use of mixtures by DDs was similar to findings from Pakistan in which 76.5% of all DDs' patients were prescribed mixtures often manufactured by the doctor (Nizami et al. 1996).

The use of mixtures is more costly compared with other formulations and compliance with good pharmacy practices is more difficult with regard to production, storage conditions, shelf-life, bottling and labelling if mixtures are not sold in the original bottle.

Consultation time

In the Pakistan study (Nizami et al. 1996), consultation time for DDs was found to be 3 minutes compared with 9 minutes for non-dispensing paediatricians. Our study also finds that DDs have a shorter consultation time as well as a higher number of patients. The reason for the shorter consultation time for DDs is not clear. Regression analysis did find high-density location to be related to reduced consultation time, which might be explained by increasing patient pressure. Caucasian practitioners were shown to have longer consultation times. This could be related to the lower representation of white patients amongst the population in Harare, resulting in a lower number of patients, or it could be related to cultural backgrounds. The finding that DDs have greater staff support could make a reduction in consultation time possible without simultaneously reducing patient care, but one cannot overlook the financial incentive of shorter consultation time. Confounders such as race and location influence the findings of shorter consultation time by DDs, however, and our study does not fully explain the findings.

The WHO core indicators offer a simple, well-defined tool that is useful for comparative studies and which can provide a reliable assessment of a few critical aspects of drug use. However, the indicators do not evaluate diagnostic precision or the prescribed treatment in relation to the recorded diagnosis or symptoms.

The predictor variables included in this study are those conventionally found to influence variations in prescribing patterns. Patient characteristics, such as economic status, age, gender and race, might also have confounded the findings. However, such an analysis was not included in the study.

Conclusion

Comparing the drug prescription habits of DDs and NDDs, this study found the major differences to be that DDs prescribe more drugs, more injections, more antibiotics and more mixtures, and spend less time per patient, which, if not justified, may jeopardize patient safety, affordability and quality of care. The fact that DDs prescribe more drugs than NDDs seems related to education undertaken in Asia. The fact that DDs prescribe more injections than NDDs seems related to density and number of patients seen per day. Shorter consultation time was related to race and location density. Despite these confounding factors (gender, race, place of education, location of the practice and patients seen per day), we still conclude that dispensing by doctors was associated with less clinically and economically appropriate prescribing.

More studies are needed to explain the findings of this study and to assess the justification for DDs' prescription habits. The findings are indicative of increased cost for the patient or society and an increased health hazard without clear benefit to the patient when treated by dispensing doctors.

This study has been undertaken in a developing country and most of the differences in prescribing patterns between DDs and NDDs found in this study are also seen in practices in other countries, developed and developing. The general practitioners included in this study are of multi-ethnic origin with 30–50% having a non-African race or education. We therefore believe that our findings might also be valid in the context outside Zimbabwe, and thereby can be an important pointer for DDs' utilization of drugs throughout the world.

Endnotes

[1] WHO (1987) defines rational therapy as: 'Sometimes the most appropriate therapy does not include drugs. When it does the rational use of drugs demands that the appropriate drug be prescribed, that it be available at the right time at a price people can afford, that it be dispensed correctly, and that it be taken in the right dose at the right interval and for the right length of time. The appropriate drug must be effective, and of acceptable quality and safety.'

[2] These numbers were chosen by WHO after statistical simulation studies with real prescription data from developing countries had confirmed that this sample size result in a 95% CI of within 7.5% in most cases.

[3] At national level 170 DDs and 1635 NDDs were registered in Zimbabwe (1996) according to Medicines Control Authorities in the country.

[4] Mixtures are liquid preparations for oral use, usually solutions, emulsions or suspensions containing one or more active substances in a suitable vehicle.

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