Home medicine chests and their relationship with self-medication in children and adolescents

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Abstract

Objective: To investigate the contents of home medicine chests and their relationship with self-medication in children and adolescents in the towns of Limeira and Piracicaba, SP, Brazil.

Methods: This is a descriptive population study based on a home survey of a simple random sample from both towns, comprising 705 households from census sectors selected by means of cluster sampling. Inclusion criteria: age ≤ 18 years; an obligatory interview with at least one guardian; inventory of medicines kept at home; and having taken at least one medication during the 15 days prior to the interview. The participants were split into two groups based on medication: self-medication (lay advice) and medical prescription. Tests of linear association were performed, in addition to a descriptive analysis of the variables and multiple logistic regression.

Results: A total of 3,619 medicines were found (mean = 5.1/household; 79.6% were pharmaceutical preparations). The rooms most commonly used to store medications were bedrooms (47.5%), kitchens (29.9%), and bathrooms (14.6%); 76.5% were in cardboard boxes and within easy reach of 142 children aged ≤ 6 years. Taking the pharmaceutical preparations in isolation (n = 2,891), the most common were analgesics/antipyretics (26.8%) and systemic antibiotics (15.3%), and the self-medication group had significantly larger stocks of these medications (p < 0.01). Storing medications in the bathroom (odds ratios = 1.59) and legal guardians with ≤ 4 years of primary education (odds ratios = 2.40) indicated greater risk of self-medication.

Conclusions: Keeping medicines at home is a common practice, and it is important to implement campaigns to encourage rational use, reduced waste and safe storage of medicines.

Introduction

Medication is the treatment most often used in health services, and in developing countries, around 30% of health resources are expended on these products. Estimates produced by the World Health Organization (WHO) indicate that 50% of all medication taken worldwide is prescribed, dispensed, sold or used incorrectly; 66% of antibiotics sold are bought without prescriptions, and incorrect use of medication is one of the top 10 causes of mortality in the United States.[1]

Faced with this situation, both developed countries and those in development have invested in programs with the objective of reducing irrational drugs use and waste, employing, with the support of the WHO, regulatory measures aimed

at promoting rational use of medicines. Of note among these measures, are licensing of medications based on evidence that they are safe, effective and of good quality; review of the classification of prescription drugs, including limiting certain medications to sale on prescription rather than over-the-counter; the establishment of educational standards for health professionals, expanding enforcement of codes of conduct, in cooperation with professional bodies and universities; registration of health professionals (physicians, pharmacists, nurses and other professionals), ensuring that they have the necessary competence for practices related to diagnosis, prescription and dispensing; licensing of pharmaceutical establishments (pharmacies and distributors), ensuring that they meet operating and dispensing standards; monitoring and regulation of drug advertising, ensuring ethical and unbiased information and that all promotional material be impartial, trustworthy and provide balanced and up-to-date information.[1-6] In this context, population-based epidemiological studies into the use of medications are a valuable tool in pharmacoepidemiology, aiding public sector management with decision-making.[1,2,7]

Despite these considerations, keeping medicines at home is a common practice and one that may represent a potential risk of damage to health.[4,5,8-11]

Home medicine chests, which are often kept in inappropriate locations and containers, offer a range of opportunities for irrational consumption and waste, including irresponsible self-medication, and they also increase the risk of both unintentional toxic exposure (particularly of small children) and intentional intoxication.[4,5,8-11] Although "responsible self-medication" (taking medicines that do not require a medical prescription to treat symptoms) may, possibly, reduce "pressure" on health systems where there are access difficulties, the procedure is contestable and is not risk free.[8,12]

Taking into consideration the above, in combination with the fact that studies investigating the characteristics of home medicine chests are rare both internationally[4,5,8,9,11] and in Brazil,[10] the objective of this study was to investigate the principal characteristics of the home medicine chests of the families of individuals selected for a population-based epidemiological study into self-medication in children and adolescents, following up on a previously published paper[13] which analyzed other variables which could have had an influence on self-medication.

Methods

This was a cross-sectional, descriptive, exploratory study based on a home survey carried out between September 8 2003 and September 7 2004 in two medium-sized provincial towns in the state of São Paulo, Brazil (Limeira and Piracicaba).

Inclusion criteria were: age ≤ 18 years, an obligatory interview with a legal guardian, having taken at least one medication during the 15 days prior to the interview, having medicines at home in addition to any drugs prescribed for treatment ongoing at the time of interview (home medicine chest) and an inventory of the household's home medicine chest. Addresses chosen during randomization were excluded if they were commercial rather than residential, if there was no legal guardian present or if the guardian refused to be interviewed, if there were no residents aged 18 years or younger, if the residents who were aged 18 or younger had not taken any medicines during the previous 15 days or if the household did not store any medications other than those being used for ongoing treatment.

Based on an estimated 41.4% of self-medication among the child population,[14] the sample size calculation stipulated a sample of 372 home interviews in the urban districts of each town, making a total of 744 cases (accepting a 5% error for an infinite sample). The calculation was based on statistics from the 2000 demographic census carried out by the Brazilian Institute of National Statistics and Geography (Instituto Brasileiro de Geografia e Estatística - IGBE), which gives an approximate total of 80,951 individuals aged 18 years or younger in Limeira and 101,800 in Piracicaba (ESTATCART 1.2, IGBE, Rio de Janeiro, RJ, Brazil, 2002).

Households were selected by simple randomization, using cluster sampling based on the urban census sectors defined by IGBE as the reference units (there are 327 sectors in Limeira and 482 in Piracicaba). Based on the estimated populations of children and adolescents in each sector, it was determined that a total of 60 sectors, taking both towns together, would be enough to achieve the sample size calculated. Nevertheless, it was decided that a larger number of sectors would actually be sampled (200), since it was expected that the minimum number of individuals stipulated might not be found, particularly in central sectors (commercial districts) and older neighborhoods with elderly residents. The IBGE map of each sector chosen was printed off (ESTATCART 1.2, IBGE, 2002), to enable interviewers to find them in the field and to locate themselves within them following a preestablished system for selecting the households to be sampled.

Data were collected by six interviewers, using a structured questionnaire with both open and closed questions. Where there was more than one child in a household, only one questionnaire was filled out, after choosing one of the children by lots using a random number table. After the interview, and with permission from the person responsible, an inventory was taken of the household's home medicine chest. While carrying out the inventory, notes were taken on the way medicines were stored, including a description of the room and containers used for storage; the therapeutic classifications of pharmaceutical preparations according to the groups and subgroups of the WHO Anatomical Therapeutic Chemical (ATC) classification system[15]; the expiry dates on products and the quantities stored; and whether the original packaging, patient information and labels were present.

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The dependent variable was classification of medication use: *self-medication*, when the decision to take medication was made by a lay person, or *on medical prescription*, when the medication was taken as a result of medical consultation and prescription for the condition that prompted its use, and with the interviewer having sight of the prescriptions concerned.

Three groups of exploratory variables were investigated: the location (room) in which medications were stored, professions connected with healthcare and the highest educational level of one of the legal guardians.

Initially, a descriptive analysis of the dependent variable and the exploratory variables was carried out. This was then followed by tests of association for comparisons of proportions (Pearson's chi-square). Variables that exhibited correlations with self-medication (p < 0.2 according to univariate analysis) were then analyzed using a multiple logistic regression model and the odds ratios and their respective 95% confidence intervals were calculated. The Mann-Whitney U test was applied to compare medians of the distributions of number of medications stored (classed as pharmaceutical preparations or manipulated, phytotherapeutic or homeopathic products) per household in the two study groups. These analyses were processed using the statistical programs Epi-Info version 6.04 (CDC/WHO, Atlanta, GE, United States); SPSS for Windows, version 7.5 (SPSS Inc., Chicago, IL, United States) and R version 2.4.1.[16]

The protocol for this study was approved by the Research Ethics Committee at the School of Medical Sciences at UNI-CAMP (hearing 510/2002); the population that took part was informed about the study objectives and the subjects' legal guardians signed consent forms.

Results

From the families of the 772 people who met the inclusion criteria for the first phase of the self-medication study,[13] 91.3% stored medications at home, restricting this analysis to a total of 705 home medicine chests (53.8% in Limeira, 46.2% in Piracicaba).

A total of 2,004 children and adolescents were living at the 705 residences chosen (2.8 per household), with a mean age of 8.5 years (median = 8 years, 25th percentile = 4 years; 75th percentile = 13 years; limits: 3 days and 18 years). The 705 home medicine chests contained 3,619 medications (mean = 5.1/household; median = 5; 25th percentile = 3; 75th percentile = 7, limits: 1 and 16; 79.6% of which were classified as pharmaceutical preparations), with similar quantities stored by both study groups (Figure 1).

The majority of medications (76.5%) were stored in cardboard boxes and, in 22.4% of households (n = 158), in bedside cabinets, unlocked drawers, on tables, under beds or below washbasins, locations easily accessed by children up
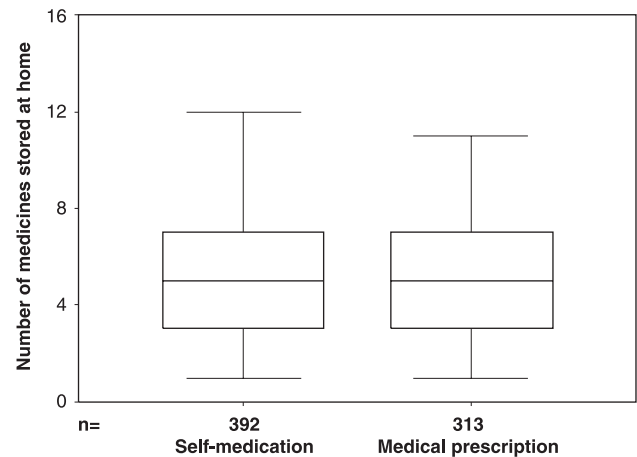
These data are represented in box and whisker plots; in each rectangle (box plot), the lower, middle and upper horizontal lines are the first quartile (25th percentile), median (50th percentile) and third quartile (75th percentile), respectively. The lower and upper limits of the vertical lines represent the lowest and highest values observed, respectively. The Mann-Whitney U test determined a p of 0.12.

Figure 1 - Graph representing the number of medicines stored per household for children and adolescents who took medicines during the 15 days prior to interview, either self-medicated or on medical prescription

to 6 years old, who accounted for 39.4% of the pediatric population living in these 158 households. In both groups, the rooms most often used to store medicines were bedrooms (47.5%), followed by kitchens (29.9%) and bathrooms (14.6%). No significant association was detected between professions related to healthcare and self-medication (Table 1). In contrast, storing medicines in the bathroom (odds ratio = 1.59) and guardians with 4 years or less of primary education (odds ratios = 2.40) both indicated a risk of self-medication (Table 2).

The type of pharmaceutical preparations most often found were analgesics/antipyretics and systemic antibiotics in both study groups, although stocks were significantly larger in the self-medication group (Table 3).

With relation to expiry dates, 12.2% of medicines had already passed their validity, 19.1% had insufficient quantities to complete a course of treatment and 33% were missing patient information leaflets or labels or something identifying the function of the medication or the way it should be used. Taking the antibiotics in isolation, 21.1% were out of date and 82.6% of the pharmaceutical preparations were part used.

Discussion

Notwithstanding the different methodologies employed, the results of this study exhibit similarities with those of studies carried out in other countries[4,5,8,9,11] and in the South of Brazil[10] (São Paulo state is in South East Brazil). There are few descriptions of the mean number of medicines stored per household, with figures that have been published varying from 4.4, through 20 and 23 to 31 medications per home.[4,9,10,11]

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Table 1 - Analysis of exploratory variables (room used to store medication, professions related to healthcare and parents' education) with relation to medication pattern (self-medication or medical prescription during the 15 days prior to an interview and inventory of home medicine chests) (Limeira and Piracicaba, SP, Brazil)

Variables	Self-medication (%) (n = 392)	Medical prescription (%) (n = 313)	p*
Room most often used to store medicines			
Bedroom	43.1	53.3	
Kitchen	31.1	28.4	
Bathroom	17.1	11.5	
Lounge	6.1	5.1	
Others	2.5	1.6	0.06
Professions related to health care†			
Yes	4.1	2.9	
No	95.9	97.1	0.51
Guardian's educational level			
Illiterate/up to 4 years' primary education	14.5	11.2	
Primary education (5 to 7 years' schooling)	25.8	24.0	
	21.2	22.7	
Secondary education/ has not graduated higher education	33.7	33.2	
Graduated higher education	4.8	8.9	0.18

* The chi-square test was used to calculate p values.
† Physician, dental surgeon, pharmacist, nurse, nursing auxiliary, pharmacy clerk or clinical pathology laboratory technician.

Table 2 - Associations between home medicine chest characteristics and self-medication during the 15 days prior to a home interview, estimated by multiple logistic regression (Limeira and Piracicaba, SP, Brazil)

Variables	Odds ratio	95% confidence intervals
Room used to store medicines		
Bathroom	1.59	1.03-2.47
Others	1.00	-
Guardian's educational level		
≤ 4 years' primary education	2.40	1.18-4.98
>4 years' education	1.00	-

However, the results of this study cannot be compared with those from Iran,[9] Belgium[11] or the South of Brazil,[10] since the authors of those studies also counted medications being taken for ongoing treatment. However, we were able to detect no differences in the number of medicines stored in the households of self-medicating individuals compared to the households of individuals taking medically prescribed medications.

Variations in the preferred room for storing medicines, in the bedroom in this population, in the kitchen in the South of Brazil[10] and in the kitchen in the refrigerator in Iran,[9] possibly reflect regional cultural differences. Nevertheless, keeping medicines in the kitchen or bathroom could lead to them

undergoing physical or chemical changes due to exposure to heat, cold, humidity and sunlight, in addition to the risk of contamination by chemical and sanitary products.[4,10] Furthermore, in this study it was observed that storing medicines in the bathroom may be a risk factor for self-medication, perhaps because the products are more easily accessed and more likely to be noticed there.

The majority of medicines were being stored in insecure containers (cardboard boxes), and just 1.3% were in first-aid boxes (toolbox style), and medication was in easy reach of 142 children up to 6 years old. This finding is comparable with other studies,[4,8,10,11] and is an indication of the importance

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Table 3 - Principal pharmaceutical preparations found in home medicine chests according to their ATC groups and subgroups and by self-medication or medical prescription during the 15 days prior to a home interview (Limeira and Piracicaba, SP, Brazil)

Pharmaceutical preparations (n = 2,891)	ATC code	Self-medication (%) (n = 1,598)*	Medical prescription (%) (n = 1,293)[†]	p[‡]
Analgesics/antipyretics	N02	28.8	24.3	< 0.01
Dipyrone	N02BB02	18.9	16.6	
Paracetamol	N02BE01	6.8	7.3	
Acetylsalicylic acid	N02BA01	3.2	0.4	
Nonsteroidal anti-inflammatories	M01A	9.2	7.7	0.16
Diclofenac	M01AB05	2.9	2.8	
Nimesulide	M01AX17	2.4	2.1	
Systemic antibiotics	J01	17.6	12.4	< 0.001
Trimethoprim-sulfamethoxazole	J01EE01	5.9	4.3	
Amoxycillin	J01CA04	4.1	2.5	
Cefaclor	J01DC04	2.9	1.8	
Alimentary tract and metabolism	A	9.6	9.2	0.78
Antispasmodics	A03	4.3	3.6	
Dimethicone	A03AX13	3.3	2.9	
H_1 antihistamines for systemic use	R06	7.2	7.9	0.52
Cough and cold preparations	R05	2.0	2.3	0.65
Adrenergic beta-agonists	R03AC	1.3	1.9	0.24
Antiprotozoals/anthelmintics	P01/ P02	2.8	1.2	< 0.01
Vitamins/antienemics	A11/ B03	1.9	3.6	< 0.01
Tricyclic antidepressants	N06A	0.9	1.5	0.19
Calcium channel blockers	C08C	0.6	1.3	0.08
Anticonvulsants	N03A	0.6	0.5	0.74

ATC = World Health Organization anatomic therapeutic chemical classification system.
* A total of 1,598 pharmaceutical preparations were found in 392 households.
[†] A total of 1,293 pharmaceutical preparations were found in 313 households.
[‡] The chi-square test was used to calculate p values.

of regular intervention programs to prevent accidents at home and of legislation to make use of medical packaging with safety caps obligatory,[17] which, unfortunately, does not yet exist in Brazil.[18] Although classically the great majority of toxic exposures affecting children up to the age of 6 years are unintentional and of low toxicity,[18,19] swallowing just two pills of a calcium channel blocker such as nifedipine or amlodipine, for example, can cause serious morbidity and, occasionally, death at this age, indicating the risk generated by lack of concern for the safe storage of these medications.[20]

In general the quantities of pharmaceutical preparations stored followed the same ranking as in a previous study in which we compared use of medications due to self-medication

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or recent medical prescription,[13] suggesting that keeping medicines at home could be one extra factor inducing self-medication,[11] particularly of analgesics/antipyretics and antibiotics for systemic use.[4,5,8-10] Furthermore, the quantity of acetylsalicylic acid stored by the self-medication group was 10 times greater than the quantity stored by the medical prescription group, indicating that this medicine is probably not bought on the basis of medical advice.

With the exception of over-the-counter analgesics/antipyretics, a large proportion of the contents of the home medicine chests was made up of controlled pharmaceutical preparations, indicating that this population is in the habit of storing medications prescribed in the past or bought without being asked for a prescription,[1] many past their expiry date and missing their original patient information leaflets or labels.[10,11] Antibiotics for systemic use were the second major group of pharmaceutical preparations stored, the majority partially consumed. The most common antibiotic was trimethoprim-sulfamethoxazole, which is similar to a description of the situation in Russia,[5] where 83.6% of a population stored antibiotics at home, according to a study that assessed a sample of 900 families living in nine large cities in Russia. Uncontrolled and imprudent use of antibiotics can result in the occurrence of serious undesirable effects, including increased resistance to antimicrobial agents, which has led the WHO to postulate that, if this tendency continues, we are on our way to a "post-antibiotic era," in which many infections will become almost impossible to treat.[21]

We did not find any difference in the pattern of consumption or frequency of storage of medicines linked to professions related to healthcare. In contrast, a study in Croatia found that stocks of nonsteroidal anti-inflammatories and antibiotics for systemic use was higher in the households of students of medicine and pharmacy, as was self-medication with these drugs.[8] Although there has been little research into the subject, there are indications that the lower the educational level, the higher the risk in terms of number of medicines stored and the practice of self-medication,[4] which is in agreement with our observations.

A range of precautions were taken to avoid bias in this study. Nevertheless, limitations must be considered. There were other data and certain correlations relating to the number and type of medicines stored that could not be established since the relevant questions were not asked during the interview and inventory. These include: whether there was anyone with a chronic disease in the family who used medicines regularly; whether previous treatment resulting from medical consultations had been complied with; an objective assessment of environmental exposure to heat, light and humidity; an estimation of the cost per household based on the number of medicines stored; and any previous history of toxic exposure of children and adolescents to medications in the households studied.

In conclusion, the results of this study demonstrate the need for interventions in health education, and within the regulatory authorities, aiming at the rational use of medications, specifically: safe storage and disposal; prevention of waste; prevention of domestic accidents involving children, truly keeping medicines out of their reach, and legislation to make safety packaging a legal obligation.

Acknowledgements

References

1. World Health Organization. The world medicines situation 2004 [site na Internet]. http://www.searo.who.int/LinkFiles/Reports_World_Medicines_Situation.pdf. Access: 15/04/2008.

2. Dukes MN. Drug utilization studies: methods and uses. WHO Regional Publications, Copenhagen: WHO European Series, No 45; 1993.

3. Hogerzeil HV. Promoting rational prescribing: an international perspective. Br J Clin Pharmacol. 1995;39:1-6.

4. Yousif MA. In-home drug storage and utilization habits: a Sudanese study. East Mediterr Health J. 2002;8:422-31.

5. Stratchounski LS, Andreeva IV, Ratchina SA, Galkin DV, Petrotchenkova NA, Demin AA, et al. The inventory of antibiotics in Russian home medicine cabinets. Clin Infec Dis. 2003;37:498-505.

6. Brasil. Ministério da Saúde. Uso racional de medicamentos [site na Internet]. http://portal.saude.gov.br/portal/saude/area.cfm?id_area=1141. Access: 11/04/2008.

7. Laporte JR. Principios de epidemiología del medicamento. 2 ed. Barcelona: Masson; 1993.

8. Aljinovic-Vučic V, Trkulja V, Lackovic Z. Content of home pharmacies and self-medication practices in households of pharmacy and medical students in Zagreb, Croatia: findings in 2001 with a reference to 1977. Croat Med J. 2005;46:74-80.

9. Zargarzadeh AH, Tavakoli N, Hassanzadeh A. A survey on the extent of medication storage and wastage in urban Iranian households. Clin Ther. 2005;27:970-8.

10. Shenkel EP, Férnandes LC, Mengue SS. Como são armazenados os medicamentos nos domicílios? Acta Farm Bonaerense. 2005;24:266-70.

11. De Bolle L, Mehuys E, Adriaens E, Remon JP, Van Bortel L, Christiaens T. Home medication cabinets and self-medication: a source of potential health threats? Ann Pharmacother. 2008;42:572-9.

12. World Health Organization-WHO. The benefits and risks of self medication. WHO Drug Information. 2000;14:1-2.

13. Pereira FS, Bucaretchi F, Stephan C, Cordeiro R. Self-medication in children and adolescents. J. Pediatr (Rio J). 2007;83:453-8.

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14. Gomes MF. Estudo da automedicação infantil em uma região administrativa no município do Rio de Janeiro [dissertação]. Rio de Janeiro (RJ): Universidade Federal do Rio de Janeiro; 2000.

15. WHO Collaborating Centre for Drug Statistic Methodology. ATC/DDD Index 2008 Oslo [site na Internet]. http://www.whocc.no/atcddd/. Access: 11/04/2008.

16. The R project for statistical computing [site na Internet]. http://www.r-project.org/ . Access: 11/04/2008.

17. Rodgers GB. The safety effects of child-resistant packaging for oral prescription of drugs. Two decades of experience. JAMA. 96; 275:1661-5.

18. Bucaretchi F, Baracat EC. Acute toxic exposure in children: an overview. J Pediatr (Rio J). 2005;81 (5 Suppl):S212-22.

19. Bronstein CA, Spyker DA, Cantilena LR Jr, Green J, Rumack BH, Heard SE. 2006 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS). Clin Toxic (Phila). 2007;45:815-917.

20. Ranniger C, Roche C. Are one or two dangerous? Calcium channel blocker exposure in toddlers. J Emerg Med. 2007;33:145-54.

21. World Health Organization. WHO global strategy for the containment of antimicrobial resistance. September 2001 [site na Internet]. http://www.who.int/csr/drugresist/guidance/en/. Access: 10/04/2008.

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