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A descriptive review of the methodologies used in household surveys on medicine utilization

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Abstract

Background: Studies carried out in the community enable researchers to understand access to medicines, affordability, and barriers to use from the consumer's point of view, and may stimulate the development of adequate medicines policies. The aim of the present article was to describe methodological and analytical aspects of quantitative studies on medicine utilization carried out at the household level.

Methods: Systematic review of original papers with data collected in studies in which the household was a sampling unit, published between 1995 and 2008. The electronic review was carried out in Medline/Pubmed, Scielo and Lilacs. The reference lists of the papers identified were examined, as well as other publications by their authors. Studies on the utilization of specific pharmacological groups, or those including only respondents with a given disease were excluded.

Results: Out of 4852 papers initially identified in the literature search, 61 fulfilled our inclusion criteria. Most studies were carried out in Europe and North America and used a cross-sectional approach. More than 80% used face-to-face interviews for data collection, and the most frequently used recall period for assessing medicine utilization was 14–15 days. In 59% of the studies, interviewers were trained to request the packaging of the medicines reported by the subjects; medical prescriptions were requested less frequently (15% of the studies).

Conclusion: These data will be useful for updating researchers on what methods their peers are currently using. Such information may help overcome challenges in the planning and analyses of future studies. Moreover, this publication may contribute to the improvement of the quality of medicine use data obtained in household surveys.

Background

Studies on the overall prevalence of medicine utilization are frequent in the scientific literature. Such studies are characterized by the investigation of any medicine used within a defined period of time. These studies represent an important tool to be used in health system evaluation.[1] Information may help draw conclusions about prevalence of diseases, treatment of adverse events, health status and quality of health care or of prescribers' behavior.[2] Studies carried out in the community also enable researchers to understand medicine use and its related aspects from the consumer's point of view, and may stimulate the development of adequate medicines policies.[3] This type of study may also help in understanding access to medicines, affordability, and barriers to use, at the community level.

In low and middle-income countries, in general, there are no computerized systems that integrate the information about medicines. Therefore, in most cases, it is not possible to carry out medicine utilization studies based on this source of information. As a result, researchers usually rely on studies with direct interviews with consumers, or investigate medical records, which are often incomplete. Taking into account that studies based on questionnaires are subject to reporting bias, it is important to use a carefully designed methodology for data collection.

The primary aim of this review is to describe the methodologies used for collecting and analyzing quantitative data on medicines use in household surveys. The paper also analyzes qualitatively the methodologies employed in the reviewed studies, and provides recommendations for future studies in the field.

Methods

A literature review was carried out using the Pubmed, Scielo and Lilacs databases. The following keywords were searched in the title or abstract of the papers: "drug(s) use", "drug(s) utilization", "drug(s) utilisation", "drug(s) usage", "drug(s) consumption", "medication use", "medication utilization", "medication usage", "medication consumption", "medicine(s) use", "medicine usage", "medicine consumption", "self-medication", "over-the-counter".

Several restriction criteria were used in the electronic search: (a) only articles published in Portuguese, English and Spanish were considered (only four papers were excluded due to this criterion); (b) only studies published between January 1995 and June 2008 were included, in order to focus on a description of the survey methods in current use; (c) only original papers were included. Studies in hospitals, schools, universities, nurseries, pharmacy counters, health clinics, and workplaces were excluded, as

well as those including only institutionalized individuals (nursing homes and prisons). Finally, studies investigating the specific use of a given pharmacological group or including only individuals with a given morbidity were not considered.

Using the keywords mentioned earlier in Pubmed, 4852 titles were found until July 2005. After reviewing their titles and abstracts, 134 original papers appeared to fulfill the inclusion criteria, and therefore, their full texts were obtained. From July 2005 to June 2008, the same search strategy was automatically repeated in Pubmed. The searches at Scielo and Lilacs added few publications, and were made in July 2005, April 2006 and June 2008. Articles detected in the electronic search were reviewed by two of the authors, who decided whether or not the manuscript fulfilled the inclusion criteria. When they disagreed, the article was discussed by the two until a final decision was reached, based on the inclusion and exclusion criteria.

The references of the selected papers were reviewed in order to find other eligible publications. A search by the names of all first authors from the selected papers was also made. In seven cases, in which more than one publication was based on the same data, only the first was included in our review. After a detailed examination of the selected papers (obtained in full), 61 fulfilled all inclusion criteria.

The original papers included in the review were classified according to several characteristics:

- Country of data collection;
- Continent of data collection: studies carried out in more than one continent were denominated '*mixed*';
- Design used: cross-sectional, cross-sectional nested within a longitudinal study, and longitudinal;
- Age groups: all ages, children only, adolescents and adults, elderly only;
- Sample size: divided into ≤ 1000 , 1001–5000, >5000 subjects;
- Sampling strategy: utilization of a random sampling strategy or not;
- Questionnaire administration mode: face-to-face interview, postal questionnaire, self-administration and telephone;

- Respondent: medicine user, medicine user and proxy, medicine user and parents, parents only, family breadwinner or any resident;
- Presentation of the survey questions that define the use of medicines in the article: yes or no;
- Presentation of data on the validity of the questionnaire used for evaluating medicine utilization: yes or no;
- Type of questions used to investigate medicine use: (a) open ended questions (in general, the first question is: "Have you used any medicine in the last xx days?" After a positive answer, a second group of questions includes identification and characterization of the medicines, following the specific objectives of the study); (b) checklists (questions about specific medicine names, pharmacological groups or diseases which are exclusively of interest to the study).
- Request for packaging presentation: yes or no;
- Request for prescription presentation: yes or no;
- Types of medicines investigated: medicines for chronic use, medicines for acute use or both;
- Indication of medicine taking: investigation of prescribed, over-the-counter or both types of medicines;
- Pharmacological group classification: classification system used for dividing medicines into pharmacological groups;
- Denominator used in the analyses: individuals, medicines or both;
- Recall period: as described in each article.

Results

Additional file 1 summarizes the 61 studies included in our review, [4-64] whereas Additional files 2 and 3 present detailed characteristics of each article. Most studies were carried out in Europe and North America (64.0%), and used cross sectional designs. Sample size was greater than 1000 subjects in two-thirds of the studies, and most (95.1%) reported using random sampling strategies. More than 80% used interviewers to collect data. In the three studies including children,[32,49,62] the information on medicine use was provided by parents. In only 30% of the studies, the questions used to define medicine utilization were presented in the publication; in 93.4%, authors did not provide information on the validity of the questionnaire used to assess medicine use. Approximately 75% of studies used open ended ques-

tions, 59% required the presentation of the medicine packaging and only 15% required the presentation of medical prescriptions. In 11.5% of studies, only medicines for chronic illness were assessed, and 90% collected information about medicines regardless of being prescribed or not. The Anatomical Therapeutic Chemical (ATC) was the most frequent pharmacological group classification system used, although 42.5% of the studies did not indicate the classification system used. Most studies used individuals as the denominator in the analyses.

The most frequently used recall period was 14 days, or two weeks, although the periods ranged from one day to two years (Figure 1). The recall period differed in studies investigating only medicines to treat chronic diseases (or for regular use)[5,28,34,50,51,56,59] compared to those evaluating medicines for acute use. The former usually asked about current use without a defined reference period. When both groups of medicines were investigated, some studies differentiated the recall period for each kind of medicine.[31,33,39,45,55]

Discussion

Data on past utilization of medicines that are collected by interview may be inaccurate, since they are subject to imprecise recall (leading to omission of medicines used), incomplete information (for example, interviewees knowing the name of a medicine, but not the dose or duration of the treatment) or even wrong information (due to misunderstanding either the question itself or the medicine treatment in use) [33,64]. As a consequence, some methodological aspects are crucial for deriving valid information on medicine use through household surveys.

The following sections discuss several key methodological aspects of household surveys on medicine utilization, summarizing the strategies used in the reviewed studies, quantified in the results section, and presenting directions and recommendations for future studies in the field.

1. Recall Period

One of the most important methodological aspects in investigating medicine utilization through questionnaires is the definition of the recall period to be used. There is no consistency in the literature regarding the ideal recall period to investigate medicine utilization. However, it is known that the prevalence of medicine utilization is extremely dependent on the recall period. For example, two population-based studies carried out two years apart in Pelotas, Brazil, using similar methodologies, found prevalence of antimicrobial use in adults of 7.3% using a recall period of 30 days, and of 5.4% using a recall period of 15 days.[13] Another study carried out in Porto Alegre, Brazil [65] collected information about medicine utilization using two recall periods. The prevalence of medicine

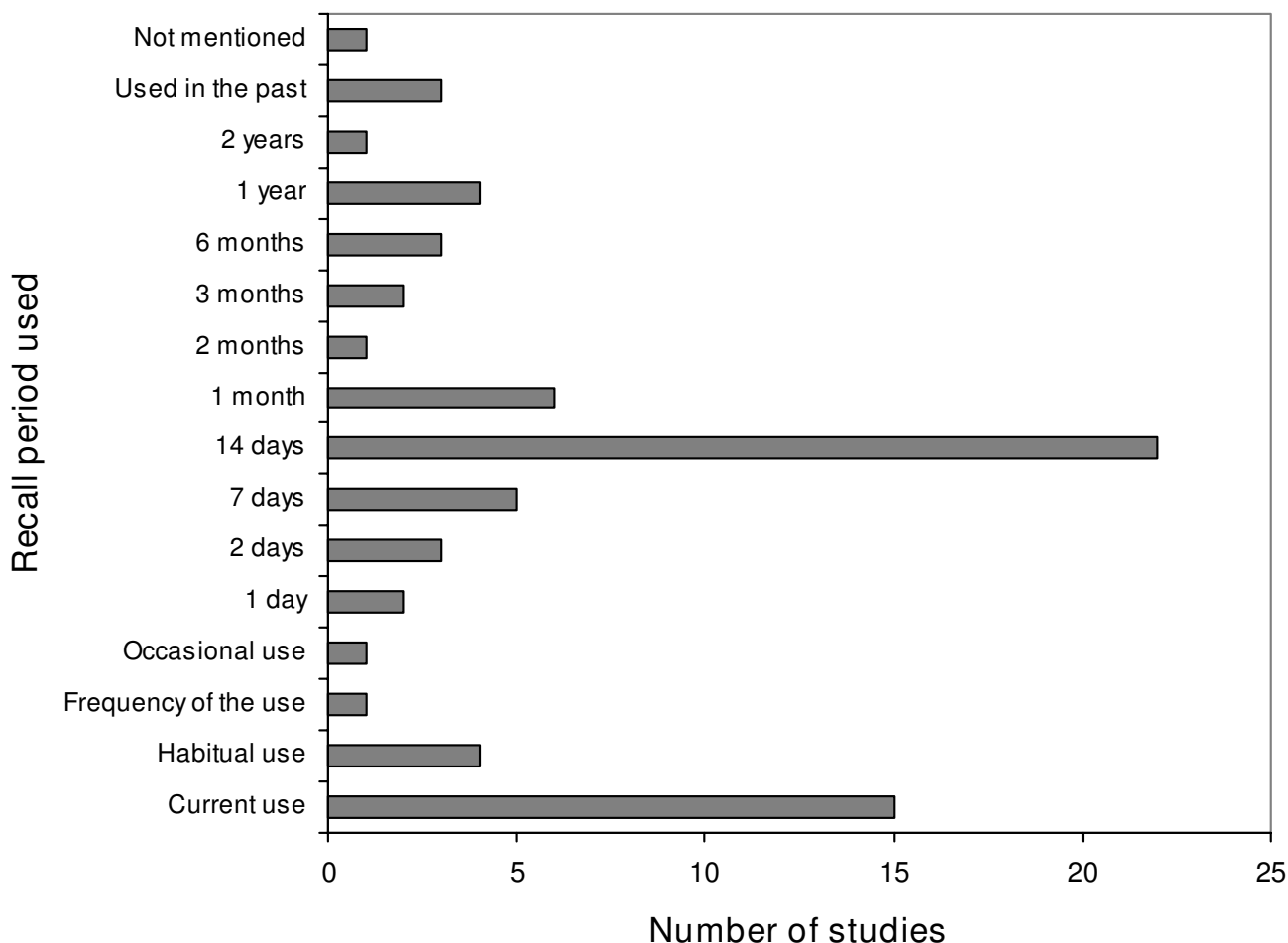


Figure 1
Distribution of the studies according to the recall period used.

utilization 15 days prior to the interview was 54.5%, and in the day before the interview, it was 35.5%.

The main methodological issue related to the choice of the recall period is the difficulty in accurately remembering and reporting use within the period. Van den Brandt et al[66] showed that the accuracy of recall of used medicines decreases with increasing age and with increasing number of prescribed medicines taken, but the investigators did not find any recall differences between men and women. In addition to the general problem of inaccurate recall, a more serious problem can occur when two or more groups to be compared have different levels of recall accuracy. Sick people may report some variables (for example, medicine use) more accurately than healthy people.[55]

The main question to be answered when selecting recall period is: to what extent it is reasonable for the sample of

respondents in this study to accurately recall details of medicines taken for the period in question? Difficulty in remembering is likely to be greater for longer period,[3] but the prevalence of medicine utilization is also likely to be greater due to accumulated medicine use during the period.[41] However, longer periods may lead to underreporting of some types of medicine, leading to underestimation of their use.[29,41]

Self-prescribed medicines are especially sensitive to difficulty at remembering.[3] A study carried out in Quenia[67] showed 60% underreporting of self-prescribed medicines when a two week recall period was used instead of one day. Medicines used regularly, such as cardiovascular medicines, may be more easily and accurately recorded using short recall periods.[27]

There is no ideal recall period for investigating medicine utilization, because selection of recall period depends on

what is to be recalled and ability of the respondent population to remember. If the goal is to compare the data with most studies in the literature, two weeks (14–15 days) is the recommended period. There is a tendency in the literature that studies on acute illnesses use shorter recall periods in comparison to those on chronic illnesses.

2. Questionnaire administration

The procedure for administering the questionnaires (face-to-face, telephone, mail interview or self-application) is another important methodological aspect to be considered. A recent Brazilian study[4] about medicine utilization in the retired population compared two approaches for investigating medicine use: a postal self-completed questionnaire and a household questionnaire completed by interviewers. Response rates were twice as high in the face-to-face approach. In Europe, studies[11,68,69] reported postal response rates ranging from 71 to 92%; in the United States, published studies reported response rates as low as 60% [70] and 40% [71] for postal questionnaires.

In low and middle-income countries, telephone coverage may be quite low, and studies using this approach are likely to be affected by selection bias. High illiteracy rates, also frequent in less developed countries, make self-administration challenging. Finally, because response rates are quite low for postal questionnaires, studies using the face-to-face approach are recommended, particularly in low and middle-income countries.

3. Questions used to assess medicine utilization

Other relevant questions for household surveys on medicine utilization are the suitability of the terminology used,[29] the clear definition of the "medicine use" variable[72] and the length of the questionnaire. In many situations, technical terminology cannot be understood by the lay population, and particularly in settings with low levels of formal education, simple terminology should be used. The definition of what constitutes a medicine must be clear, considering that some medicines such as analgesics, natural products, medicines for topical use may not be reported by the respondents.[72]

In the study by Flores[27], it was noted that the level of information about the medicine concept was low. The interviewees frequently failed to report medicines to reduce weight, allergies, pain, diarrhea, kidney or bladder problems, digestive problems, colds or any kind of vitamins[27]. In terms of the length of the questionnaire, a study by Acurcio[4] suggested that the length of the postal questionnaire was one possible cause of low response rate.

In summary, researchers should use simple, but technically correct terminology. Efforts should be made to state clearly the definition of medicines to be used in the study, and special attention should be paid to prompting respondents for information about analgesics, natural products, medicines for topical use, and others that they may consider to be 'less important'.

4. Types of questions for investigating medicine utilization

Kimmel et al[73] studied the effect of reading a list of medicines and the presentation of photos as a prompt to recall the used medicines in a case-control study, which resulted in a 6% increase in the previously recalled medicines. Flores and Mengue,[27] studying overall medicine utilization in the elderly, found a prevalence of 86% using an open ended question, and 91% using a checklist.

Open ended questions are preferred for studies evaluating overall medicine utilization. Checklists should be used when authors are particularly interested in a given disease, pharmacological group or specific medicine names. The question(s) used for assessing medicine utilization should be presented in the articles, so that other researchers can replicate the method in future studies. Unfortunately, the majority of studies reviewed did not present the main question used to assess medicine utilization.

5. Implications of using information provided by relatives or caregivers

Because most studies on medicine utilization include elderly subjects, methodological attempts to improve the accuracy of the information on medicine use are a priority. Medicine use of the elderly differs considerably from other age groups.[74] The high number of medicines used, hearing and visual impairments, and lack of memory may reduce the quality of the information given. More serious morbidities may preclude direct interview. Some studies decided to exclude the subjects not able to answer the questionnaire.[13]

In order to minimize this problem, some researchers have opted to interview close relatives or caregivers for the total or partial collection of information about medicine utilization.[75] In some situations, such information may be more reliable and valid.[30] One should note that only 26.3% of the studies including only elderly subjects opted to use this strategy. However, other publications may simply have failed to report this kind of information about the data collection process.

Excluding elderly subjects without ability to answer a questionnaire on medicine utilization will underestimate the prevalence of medicine use, because these subjects are more likely to have medicine utilization. Therefore, the utilization of proxy information is recommended, partic-

ularly in studies with elderly subjects. Finally, authors should mention in the articles whether or not this strategy was used, so that other researchers would be able to replicate the methodology used, and correctly interpret the findings of the study.

6. Packaging and prescription presentation

One way to validate the data on medicine utilization and even to add recall about what was used in a specific period is to ask for the medicine packaging. This strategy is particularly useful in household studies, where, medicines tend to be stocked. As presented in Additional file 1, the majority of the studies reviewed asked for the packaging presentation. In some studies, the interviewees were asked to show all the used medicines at the moment or in the past. The interviewer had the task of selecting the eligible medicines for the study. In other cases, the interviewers asked only for the presentation of the medicines concerned with the study.

The request to see prescriptions may also be used to validate or qualify the data collected, because researchers may be able to correctly identify the name and characteristics of the medicines taken. In spite of its potential benefits, this strategy was used in only 15% of the studies reviewed.

7. Medicines for regular use and medicines used occasionally

Most household surveys on medicine utilization investigated medicines for treating both chronic and acute diseases. However, characterization of what constitutes regular use differs across studies. Some approaches are: use of medicine habitually;[55] use of medicines on a regular basis or continuously;[39,45] current use;[16,31,33] medicines used with fixed-time interval or for repetitive disease occurrence;[51] medicines to chronic diseases;[50] and medicines used regularly, without a date to stop.[13]

Considering that the terminology used may affect the interviewee's answer, it is important to clarify exactly what is intended. For example, oral contraceptives are medicines used regularly, but they are not used to treat chronic diseases as the majority of the other medicines included in this group.

Another issue to consider is the duration of time using a medicine in order to it to be considered chronically or habitually used. Some prophylactic treatments with antibiotics are long, but temporary. Should they be considered for chronic or acute use? In this sense, the utilization of terms like "habitual" or "chronic" seem to be more appropriate than the definition based on the number of days in treatment. The term "without date to stop" may be a useful alternative to differentiate the types of medicines.

8. Pharmacological group classification

When the study requires a classification into pharmacological groups, the quality of the information is a concern, and presentation of the medicine packaging or prescription is a useful practice.[76] Almost half of the reviewed studies did not indicate the system used to classify the medicines by pharmacological groups.

Many medicines have two or more indications; in order to classify medicines into pharmacological groups, it is essential to know which health problem the medicine was used for. In the case of acetylsalicylic acid, for example, the ATC code N02BA01 would identify use as an analgesic, while B01AC06 would identify use as a platelet aggregation inhibitor.

There is no ideal system for classifying medicines into pharmacological groups. However, it is extremely important that authors mention the system chosen, in order to allow comparisons across studies.

9. Denominators used in the analyses

Medicine utilization may be analyzed using either the total number of subjects in the sample or the total number of reported medicines as the denominator, which can lead to very different conclusions about the prevalence of use of different types of medicines. Some studies do not inform about which kind of denominator was used in the analyses, making it difficult to interpret the data or compare across studies.

In studies of individual determinants of medicine utilization, the denominator should be the number of subjects in the sample. In studies on the characteristics of the medicines used, both approaches have been used. In the first approach, each line in the database will correspond to a subject, while in the second one, each line in the database corresponds to a medicine used. This aspect was recently discussed in a review paper.[72]

In studies of specific pharmacological groups, one may be interested in reporting the prevalence of antimicrobial use in the studied population (denominator = number of individuals) or the proportion of antimicrobials in the total number of medicines used in the sample (denominator = number of medicines).

In a study about utilization of generic medicines,[77] both approaches resulted in very similar values; 3.9% (over the total of medicines) and 3.6% (over the total of subjects in the sample). However, this is not always the case. Bertoldi et al. [13] found that 16.5% of the medicines used were non-opioid analgesics. However, 32.2% of the respondents used at least one non-opioid analgesic in the period investigated. These findings show the impor-

tance of the denominator in the interpretation of the studies, and highlight the need to state clearly which denominator is used in each analysis.

Conclusion

The present review focused on the methods used in 61 household surveys of medicine utilization published between January 1995 and June 2008. These data will be useful for updating researchers on current standards of practice, and may help overcome challenges in the planning and analyses of such studies. Moreover, recommendations in this publication may help to improve the quality of the data about medicine use obtained in household surveys.

Given that studies are conducted for different purposes, a certain degree of heterogeneity in methods is expected. However, standardization of certain practices would be beneficial. For example, international and regional comparisons of medicine utilization prevalence would benefit from the utilization of consistent methodologies. Actually, the World Health Organization has tried to overcome the problem, by proposing standard instruments. In the 2002 World Health Survey, a standardized questionnaire including some questions on medicine access, affordability and use, was administered in 53 countries[78].

Regardless of the issue of standardization, some publications lack important details on the methodologies used, for example, the system used to classify medicines into pharmacological groups or the question used to investigate the main outcome variable. Authors should provide such details in the articles, so that other researchers may adequately replicate studies in different settings. Finally, because data on the reliability and validity of medicine use questionnaires are rare, it is uncertain if the instruments currently in use are accurately assessing the construct of medicine utilization.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

ADB led the literature review process, the writing and analyses of the manuscript. AJDB, AW and DR-D approved the search strategy, revised the text and contributed in the planning of the review. PCH conducted the literature review with ADB, assessed each article in terms of the inclusion criteria and helped writing the manuscript and analyzing the data.

Additional material

Additional file 1

Table 1. Quantification of methodological characteristics of the 61 household surveys on medicine utilization included in the review.

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Additional file 2

Table 2. Description of the studies included in the review according to methodological characteristics – part I.

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Additional file 3

Table 3. Description of the studies included in the review according to methodological characteristics – part II.

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References

- Laporte JR, Porta M, Capellà D: **Drug utilization studies: a tool for determining the effectiveness of drug use.** *Br J Clin Pharmacol* 1983, **16(3)**:301-304.
- Neutel CI: **Drug Utilization Patterns as Indicators.** *Pharmacoepidemiol Drug Saf* 1998, **7**:131-133.
- Geest S Van Der, Hardon A: **Drugs use: methodological suggestions for field research in developing countries.** *Health Policy and Planning* 1988, **3(2)**:152-158.
- Acurcio FA, Rozenfeld S, Ribeiro AQ, Klein CH, Moura CS, Andrade CR: **Use of medications by elderly Brazilian retirees. I - Methodology and response rates of a multicenter survey.** *Cadernos de Saúde Pública* 2006, **22(1)**:87-96.
- Agostini JV, Han L, Tinetti ME: **The relationship between number of medications and weight loss or impaired balance in older adults.** *J Am Geriatr Soc* 2004, **52(10)**:1719-1723.
- Al-Windi A, Elmfeldt D, Svardssudd K: **The relationship between age, gender, well-being and symptoms, and the use of pharmaceuticals, herbal medicines and self-care products in a Swedish municipality.** *Eur J Clin Pharmacol* 2000, **56(4)**:311-317.
- Amare G, Gedif T, Alemayehu T, Tesfahun B: **Pattern of drug use in Addis Ababa community.** *East Afr Med J* 1997, **74(6)**:362-367.
- Arrais PS, Brito LL, Barreto ML, Coelho HL: **[Prevalence and determinants of medicines consumption in Fortaleza, Ceara, Brazil].** *Cad Saude Publica* 2005, **21(6)**:1737-1746.
- Awad AI, Eltayeb IB, Capps PA: **Self-medication practices in Khartoum State, Sudan.** *Eur J Clin Pharmacol* 2006, **62(4)**:317-324.
- Barat I, Andreasen F, Damsgaard EM: **The consumption of drugs by 75-year-old individuals living in their own homes.** *Eur J Clin Pharmacol* 2000, **56(6-7)**:501-509.
- Bardel A, Wallander MA, Svardssudd K: **Reported current use of prescription drugs and some of its determinants among 35 to 65-year-old women in mid-Sweden: A population-based study.** *J Clin Epidemiol* 2000, **53(6)**:637-643.
- Barros e Sá M, Cabral de Barros JA, Sá MPBdO: **Self-medication in the elderly of the city of Salgueiro, State of Pernambuco.** *Revista Brasileira de Epidemiologia* 2007, **10(1)**:75-85.
- Bertoldi AD, Barros AJ, Hallal PC, Lima RC: **[Drug utilization in adults: prevalence and individuals determinants].** *Rev Saude Publica* 2004, **38(2)**:228-238.
- Blalock SJ, Byrd JE, Hansen RA, Yamanis TJ, McMullin K, DeVellis BM, DeVellis RF, Panter AT, Kawata AK, Watson LC, et al.: **Factors associated with potentially inappropriate drug utilization in a**

- sample of rural community-dwelling older adults. *Am J Geriatr Pharmacother* 2005, **3(3)**:168-179.
15. Brekke M, Hunskaar S, Straand J: **Self-reported drug utilization, health, and lifestyle factors among 70-74 year old community dwelling individuals in Western Norway. The Hordaland Health Study (HUSK).** *BMC Public Health* 2006, **6**:121.
 16. Brzozowska A, Enzi G, Amorin Cruz J: **Medicine use and supplementation practice among participants of SENECA Study.** *J Nutr Health Aging* 2002, **6(1)**:34-38.
 17. Carrasco-Garrido P, Jimenez-Garcia R, Barrera VH, Gil de Miguel A: **Predictive factors of self-medicated drug use among the Spanish adult population.** *Pharmacoepidemiol Drug Saf* 2008, **17(2)**:193-199.
 18. Carvalho MF, Pascom AR, Souza-Junior PR, Damacena GN, Szwarcwald CL: **Utilization of medicines by the Brazilian population, 2003.** *Cad Saude Pública* 2005, **21(Suppl)**:100-108.
 19. Chen YF, Dewey ME, Avery AJ: **Self-reported medication use for older people in England and Wales.** *J Clin Pharm Ther* 2001, **26(2)**:129-140.
 20. Coelho Filho JM, Marcopito LF, Castelo A: **[Medication use patterns among elderly people in urban area in Northeastern Brazil].** *Rev Saude Publica* 2004, **38(4)**:557-564.
 21. Cohen I, Rogers P, Burke V, Beilin LJ: **Predictors of medication use, compliance and symptoms of hypotension in a community-based sample of elderly men and women.** *J Clin Pharm Ther* 1998, **23(6)**:423-432.
 22. Del Rio MC, Prada C, Alvarez FJ: **The use of medication by the Spanish population.** *Pharmacoepidemiol Drug Saf* 1997, **6(1)**:41-48.
 23. Eggen AE: **Patterns of medicine use in a general population (0-80 years). The Influence of age, gender, diseases and place of residence on drug use in Norway.** *Pharmacoepidemiol Drug Saf* 1997, **6(3)**:179-187.
 24. Espino DV, Lichtenstein MJ, Hazuda HP, Fabrizio D, Wood RC, Goodwin J, Stroup-Benham CA, Markides KS: **Correlates of prescription and over-the-counter medication usage among older Mexican Americans: the Hispanic EPESE study. Established Population for the Epidemiologic Study of the Elderly.** *J Am Geriatr Soc* 1998, **46(10)**:1228-1234.
 25. Figueiras A, Caamano F, Gestal-Otero JJ: **Sociodemographic factors related to self-medication in Spain.** *Eur J Epidemiol* 2000, **16(1)**:19-26.
 26. Fillenbaum GG, Horner RD, Hanlon JT, Landerman LR, Dawson DV, Cohen HJ: **Factors predicting change in prescription and non-prescription drug use in a community-residing black and white elderly population.** *J Clin Epidemiol* 1996, **49(5)**:587-593.
 27. Flores LM, Mengue SS: **[Drug use by the elderly in Southern Brazil].** *Rev Saude Publica* 2005, **39(6)**:924-929.
 28. Fuchs Z, Novikov I, Blumstein T, Chetrit A, Gindin J, Modan B: **Patterns of drug use among the community-dwelling old-old population in Israel.** *Isr Med Assoc J* 2003, **5(5)**:346-351.
 29. Furu K, Straume B, Thelle DS: **Legal drug use in a general population: association with gender, morbidity, health care utilization, and lifestyle characteristics.** *J Clin Epidemiol* 1997, **50(3)**:341-349.
 30. Gama EV, Rodriguez Artalejo F, Palacios Diaz A, Gabarre Orus P, Perez del Molino Martin J: **[Drug consumption by the elderly: results of population studies].** *Rev Esp Salud Publica* 1998, **72(3)**:209-219.
 31. Hach I, Rentsch A, Ruhl UE, Becker ES, Turke V, Margraf J, Kirch W: **Drug use patterns in young German women and association with mental disorders.** *Ann Pharmacother* 2004, **38(9)**:1529-1534.
 32. Headley J, Northstone K: **Medication administered to children from 0 to 7.5 years in the Avon Longitudinal Study of Parents and Children (ALSPAC).** *Eur J Clin Pharmacol* 2007, **63(2)**:189-195.
 33. Hershman DL, Simonoff PA, Frishman WH, Paston F, Aronson MK: **Drug utilization in the old old and how it relates to self-perceived health and all-cause mortality: results from the Bronx Aging Study.** *J Am Geriatr Soc* 1995, **43(4)**:356-360.
 34. Hidalgo JL-T, Cerda Diaz R, Fernandez Olano C, Requena Gallego M, Fernandez Casalderrey C, Otero Puime A: **[Factors associated with chronic drug consumption in the elderly].** *Med Clin (Barc)* 1997, **108(15)**:572-576.
 35. Hogan DB, Ebly EM, Fung TS: **Regional variations in use of potentially inappropriate medications by Canadian seniors participating in the Canadian Study of Health and Aging.** *Can J Clin Pharmacol* 1995, **2(4)**:167-174.
 36. Izzazola-Conde C, Kotelchuck M: **Prevalence of medicinal drug usage among the Mexican general population according to National Health Survey I.** *Proc West Pharmacol Soc* 1998, **41**:183-186.
 37. Johnson RE, Ried LD: **OTC drug use in an HMO: comparing the elderly and younger adults.** *J Aging Health* 1996, **8(1)**:114-135.
 38. Kaufman DV, Kelly JP, Rosenberg L, Anderson TE, Mitchell AA: **Recent patterns of medication use in the ambulatory adult population of the United States: the Slone survey.** *Jama* 2002, **287(3)**:337-344.
 39. Klarin I, Fastbom J, Wimo A: **A population-based study of drug use in the very old living in a rural district of Sweden, with focus on cardiovascular drug consumption: comparison with an urban cohort.** *Pharmacoepidemiol Drug Saf* 2003, **12(8)**:669-678.
 40. Lassila HC, Stoehr GP, Ganguli M, Seaberg EC, Gilby JE, Belle SH, Echement DA: **Use of prescription medications in an elderly rural population: the MoVIES Project.** *Ann Pharmacother* 1996, **30(6)**:589-595.
 41. Loyola Filho AI, Uchoa E, Guerra HL, Firmo JO, Lima-Costa MF: **[Prevalence and factors associated with self-medication: the Bambui health survey].** *Rev Saude Publica* 2002, **36(1)**:55-62.
 42. Loyola Filho AI, Uchoa E, Lima-Costa MF: **[A population-based study on use of medication by the elderly in Greater Metropolitan Belo Horizonte, Minas Gerais, Brazil].** *Cad Saude Publica* 2006, **22(12)**:2657-2667.
 43. Miralles MA, Kimberlin CL: **Perceived access to care and medication use among ambulatory elderly in Rio de Janeiro, Brazil.** *Soc Sci Med* 1998, **46(3)**:345-355.
 44. Moxey ED, O'Connor JP, Novielli KD, Teutsch S, Nash DB: **Prescription drug use in the elderly: a descriptive analysis.** *Health Care Financ Rev* 2003, **24(4)**:127-141.
 45. Nielsen MW, Hansen EH, Rasmussen NK: **Prescription and non-prescription medicine use in Denmark: association with socio-economic position.** *Eur J Clin Pharmacol* 2003, **59(8-9)**:677-684.
 46. Obermeyer CM, Price K, Schulein M, Sievert LL, Anderton DL: **Medication use and gender in Massachusetts: results of a household survey.** *Health Care Women Int* 2007, **28(7)**:593-613.
 47. Obermeyer CM, Schulein M, Hardon A, Sievert LL, Price K, Santiago AC, Lazcano O, Kirumira EK, Neuman M: **Gender and medication use: an exploratory, multi-site study.** *Women Health* 2004, **39(4)**:57-73.
 48. Obermeyer CM, Schulein M, Kasparian C, Ammar W: **Medication use, gender, and socio-economic status in Lebanon: analysis of a national survey.** *J Med Liban* 2002, **50(5-6)**:216-225.
 49. Rajmil L, Ruiz C, Segura JL, Fernandez E, Segura A: **[Factors related to drug consumption in children's population].** *Med Clin (Barc)* 2000, **114(6)**:214-216.
 50. Recalde JM, Zunzunegui MV, Beland F: **[Interaction of prescribed drugs in a population over 65 years of age].** *Aten Primaria* 1998, **22(7)**:434-439.
 51. Rosholm JU, Christensen K: **Relationship between drug use and self-reported health in elderly Danes.** *Eur J Clin Pharmacol* 1997, **53(3-4)**:179-183.
 52. Sans S, Paluzie G, Puig T, Balana L, Balaguer-Vintro II: **[Prevalence of drug utilization in the adult population of Catalonia, Spain].** *Gac Sanit* 2002, **16(2)**:121-130.
 53. Shankar PR, Kumar P, Theodore AM, Partha P, Shenoy N: **A survey of drug use patterns in western Nepal.** *Singapore Med J* 2003, **44(7)**:352-356.
 54. Shankar PR, Partha P, Shenoy N: **Self-medication and non-doctor prescription practices in Pokhara valley, Western Nepal: a questionnaire-based study.** *BMC Fam Pract* 2002, **3(1)**:17.
 55. Simoni M, Pedreschi M, Baldacci S, Pistelli F, Carrozzi L, Sapigni T, Viegi G: **The Po River Delta epidemiological study: use of medicines in a general population sample of north Italy.** *Pharmacoepidemiol Drug Saf* 2000, **9(4)**:319-326.
 56. Steyn K, Bradshaw D, Norman R, Bradley H, Laubscher R: **The use of prescribed drugs for common chronic conditions in South Africa in 1998.** *Pharmacoepidemiol Drug Saf* 2005, **14(2)**:91-100.
 57. Stoehr GP, Ganguli M, Seaberg EC, Echement DA, Belle S: **Over-the-counter medication use in an older rural community: the MoVIES Project.** *J Am Geriatr Soc* 1997, **45(2)**:158-165.

58. Thomas HF, Sweetnam PM, Janchawee B, Luscombe DK: **Polypharmacy among older men in South Wales.** *Eur J Clin Pharmacol* 1999, **55(5)**:411-415.
59. Vega Quiroga S, Lopez Gay L, Bermejo Pareja F, de la Rosa Gil L, de Bustos Tabernero M, Sampedro Lopez MD, Fraile Jimeno M, Duran Parra F, Moreno Sobrino T, Gabriel Sanchez R: **[Drug consumption by people over 60 years of age in a rural area].** *Aten Primaria* 1996, **17(8)**:496-500.
60. Vilarino JF, Soares IC, da Silveira CM, Rodel AP, Bortoli R, Lemos RR: **[Self-medication profile in a city of south Brazil].** *Rev Saude Publica* 1998, **32(1)**:43-49.
61. Wallsten SM, Sullivan RJ Jr, Hanlon JT, Blazer DG, Tyrey MJ, Westlund R: **Medication taking behaviors in the high- and low-functioning elderly: MacArthur field studies of successful aging.** *Ann Pharmacother* 1995, **29(4)**:359-364.
62. Weiderpass E, Beria JU, Barros FC, Victora CG, Tomasi E, Halpern R: **[Epidemiology of drug use during the first three months of life in a urban area of southern Brazil].** *Rev Saude Publica* 1998, **32(4)**:335-344.
63. Wills P, Claesson CB, Fratiglioni L, Fastbom J, Thorslund M, Winblad B: **Drug use by demented and non-demented elderly people.** *Age Ageing* 1997, **26(5)**:383-391.
64. Woo J, Ho SC, Yuen YK, Lau J: **Drug use in an elderly Chinese population: prevalence and associated factors.** *Gerontology* 1995, **41(2)**:98-108.
65. Bertoldi AD, Barros AJD, Wagner A, Ross-Degnan D, Hallal PC: **Medicine access and utilization in a population covered by primary health care in Brazil.** *Health Policy* 2008 in press.
66. Brandt PA Van Den, et al.: **Comparison of questionnaire information and pharmacy data on drug.** *Pharm Weekbl Sci* 1991, **13**:91-96.
67. Schulpen TWJ, Swinkels WJAM: **The utilization of health services in a rural area of Kenya.** *Trop geogr Med* 1980, **32**:340-349.
68. Eggen AE: **Pattern of drug use in a general population – prevalence and predicting factors: the Tromso study.** *Int J Epidemiol* 1994, **23(6)**:1262-1270.
69. Pitkala KH, Strandberg TE, Tilvis RS: **Inappropriate drug prescription in home-dwelling, elderly patients: a population-based survey.** *Arch Intern Med* 2002, **162**:1707-1712.
70. Asch DA, Jedrzejewski MK, Christakis NA: **Response rates to mail surveys published in medical journals.** *J Clin Epidemiol* 1997, **50(10)**:1129-1136.
71. Hoffman SC, Burke AE, Helzlsouer KJ, Comstock GW: **Controlled trial of the effect of length, incentives, and follow-up techniques on response to a mailed questionnaire.** *Am J Epidemiol* 1998, **148(10)**:1007-1011.
72. Rozenfeld S, Valente J: **Estudos de utilização de medicamentos – considerações técnicas sobre coleta e análise de dados.** *Epidemiologia e Serviços de Saúde* 2004, **13**:115-123.
73. Kimmel SE, Lewis JD, Jaskowiak J, Kishel L, Hennessy S: **Enhancement of medication recall using medication pictures and lists in telephone interviews.** *Pharmacoepidemiol Drug Saf* 2003, **12(1)**:1-8.
74. Rozenfeld S: **[Prevalence, associated factors, and misuse of medication in the elderly: a review].** *Cad Saude Publica* 2003, **19(3)**:717-724.
75. Linjakumpu TA, Hartikainen SA, Klaukka TJ, Koponen HJ, Hakko HH, Viilo KM, Haapea M, Kivela SL, Isoaho RE: **Sedative drug use in the home-dwelling elderly.** *Ann Pharmacother* 2004, **38(12)**:2017-2022.
76. Monster TB, Janssen WM, de Jong PE, de Jong-van den Berg LT: **Pharmacy data in epidemiological studies: an easy to obtain and reliable tool.** *Pharmacoepidemiol Drug Saf* 2002, **11(5)**:379-384.
77. Bertoldi AD, Barros AJ, Hallal PC: **Generic drugs in Brazil: known by many, used by few.** *Cad Saude Publica* 2005, **21(6)**:1808-1815.
78. **World Health Survey** [<http://www.who.int/healthinfo/survey/en/index.html>]

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