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SYSTEMATIC REVIEW

Adverse Health Events Related to Self-Medication Practices Among Elderly: A Systematic Review

Médéa Locquet[1] · Germain Honvo[1] · Véronique Rabenda[1] · Thierry Van Hees[2] · Jean Petermans[3] · Jean-Yves Reginster[1] · Olivier Bruyère[1]

Abstract

Background Older adults often resort to self-medication to relieve symptoms of their current illnesses; however, the risks of this practice are multiplied in old age. In particular, this age group is more vulnerable to adverse drug events because of the physiological changes that occur due to senescence.

Objective The aim of the study was to obtain an overview of the adverse health events related to self-medication among subjects aged 60 years and over through a systematic review of the literature.

Methods A study of relevant articles was conducted among databases (MEDLINE, PsycINFO, and EBM Reviews–Cochrane Database of Systematic Reviews). Eligibility criteria were established and applied by two investigators to include suitable studies. The results and outcomes of interest were detailed in a descriptive report.

Results The electronic search identified 4096 references, and the full texts of 74 were reviewed, of which four were retained in the analysis: three had a cross-sectional design and one prospectively followed elderly subjects. The first study showed a 26.7% prevalence of adverse drug reactions (ADRs) among elders, the second study found a 75% prevalence of side effects, and, finally, a prospective study showed an ADR incidence of 4.5% among self-medicated elders. These studies showed that adverse health events related to self-medication are relatively frequently reported. They also highlighted that analgesics and anti-inflammatory drugs are the most self-medicated products, while vitamins and dietary supplements also appear to be frequently self-administered, but by older individuals.

Conclusions Studies on self-medication in the elderly and its adverse health effects are clearly lacking. There is a need to perform prospective studies on this topic to gain a clear understanding of the extent of this problem and to enhance the awareness of health professionals to better inform seniors.

Key Points

Self-medication is a common and widespread behavior, particularly among the elderly because of co-morbidities.

This practice could lead to important adverse health events but there is a lack of data highlighting this phenomenon among older people.

Prospective pharmaco-epidemiological studies are needed to understand the extent of this practice and thus protect elders' health.

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✉ Médéa Locquet
medea.locquet@ulg.ac.be

[1] Department of Public Health, Epidemiology and Health Economics, University of Liège, Liège, Belgium

[2] Department of Clinical Pharmacy, CIRM (Center for Interdisciplinary Research on Medicines), University of Liège, Liège, Belgium

[3] Geriatric Department, CHU of Liège, Liège, Belgium

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1 Introduction

Self-medication is a behavior that is widely practiced worldwide. Although a universally accepted definition of self-medication does not currently exist, the World Health Organization (WHO) describes it as the "selection and use of (herbal or chemical) medicines by individuals to treat self-recognized illnesses or symptoms" [1]. From a broader perspective, self-medication involves not only the consumption of over-the-counter (OTC) products but also the re-use of formerly prescribed drugs without medical supervision [2].

Although responsible self-medication practices can provide clear benefits (e.g., reduction in community-funded health expenses), this practice can lead to adverse events on individual health as well as negative consequences at the community level [3]. In addition to the risk of an incorrect or delayed diagnosis and prolonged suffering associated with an illness [4], self-medication may induce serious health hazards such as adverse drug reactions (ADRs) [5].

Older people have a greater likelihood of resorting to self-medication because of their co-morbidities. They therefore consume more products, formerly prescribed or OTC, for self-treatment purposes and their risk of adverse health events is thus increased. In addition, physiological changes in metabolism (i.e., pharmacokinetics and pharmacodynamics) associated with the aging process make the elderly more vulnerable to ADRs [6]. However, although the incidence of ADRs is very high in the elderly [7–9], many of the events seem to be preventable with adequate prevention strategies [10].

Moreover, a recent systematic review [11] showed that self-medication behaviors are common among elders, with a prevalence ranging between 20 and 60%, depending on the study. However, no studies have aimed to systematically assess self-medication-related adverse outcomes in the elderly. Based on these findings, we conducted a detailed and systematic literature review to gain general insight into the existing relevant data regarding the adverse health events of self-medication in the elderly.

2 Methods

Throughout the review process, the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) statement was followed.

2.1 Search Strategy

The following electronic databases were consulted, with no date limitations: MEDLINE, PsycINFO, and EBM Reviews–Cochrane Database of Systematic Reviews. This electronic search was conducted in April 2015. The main keywords and Boolean operators (OR, AND) used were as follows: elderly OR older adults AND self-medication OR over-the-counter OR formerly prescribed drugs AND side effects OR adverse drug reactions OR hospital admissions. We included multiple combinations of these search terms (Electronic Supplementary Material Appendix S1). In addition to the electronic search, we performed a manual search of the bibliographical references of relevant articles to identify other potentially interesting studies. An update was undertaken in January 2017 following the same search strategy.

2.2 Article Selection Process

In the first step, two independent investigators screened all of the titles and abstracts of the papers identified by the electronic search to exclude irrelevant studies from our systematic review. For this step, strict eligibility criteria were established (see Table 1) regarding the type of participants and the definition of self-medication and of the outcome. All types of study design were considered, except non-systematic review and case reports. No limitations on the publication date were applied, but we limited the articles to those written in French and English. If there were disagreements between the two investigators, discussions were held to reach a consensus.

In the second step, all previously selected articles were fully reviewed by one investigator to determine if they met the eligibility criteria. Again, if there was any doubt about

Table 1 Eligibility criteria

Design	All types of design except for non-systematic reviews and case reports
Participants	Men and women aged 60 years or over (according to the World Health Organization definition of elderly [12])
Definition of self-medication	Over-the-counter products, formerly prescribed products, vitamin and mineral supplements, and any other product from which individuals expect a pharmacological effect and which they consume without guidance from healthcare professionals [1, 2]
Outcome	All types of unwanted and adverse health events (e.g., adverse drug reactions, side effects of drugs, hospital admissions)
Language	English or French

the inclusion of an article, the decision was resolved through discussion.

2.3 Data Extraction

According to a specific pre-established protocol, the following characteristics were extracted by one investigator: name of first author, year of publication, country of origin, study setting, population sampled, recall period, definition of self-medication, products consumed, and measure of outcomes.

We systematically contacted the authors and co-authors of the articles of interest when relevant information was missing from the full-text version to include a maximum number of studies in our systematic review.

2.4 Methodology Quality Assessment

In order to assess the methodological quality of each study and their risk of bias, the Joanna Briggs Institute critical appraisal tools [13] were employed. Two reviewers independently proceeded to the critical assessment of the studies, answering "Yes", "No", "Unclear", or "Not applicable" to eight questions (for cross-sectional studies) or 11 questions (for the cohort study) about methodological main concerns. Disagreements were solved by discussion until reaching a consensual decision. Arbitrarily, by summing the number of domains for which we answered "Yes", we decided to classify the studies as at "high", "medium", or "low" risk of bias (the higher the number of "Yes" answers, the lower the risk of bias).

2.5 Presentation of the Synthesized Results

A descriptive analysis of the included studies was performed. This study therefore provides a narrative report, including tables and figures to facilitate the reading and to clarify the findings.

3 Results

3.1 Literature Search Results

Figure 1 provides an overview of the selection process. The search of the electronic databases yielded 4096 publications (3323 in the MEDLINE database, 438 in the PsycINFO database, and 335 in the EBM Reviews–Cochrane Database of Systematic Reviews). Subsequently, 189 duplicates were excluded followed by a further 3833 papers (including 44 not in English or French) after title

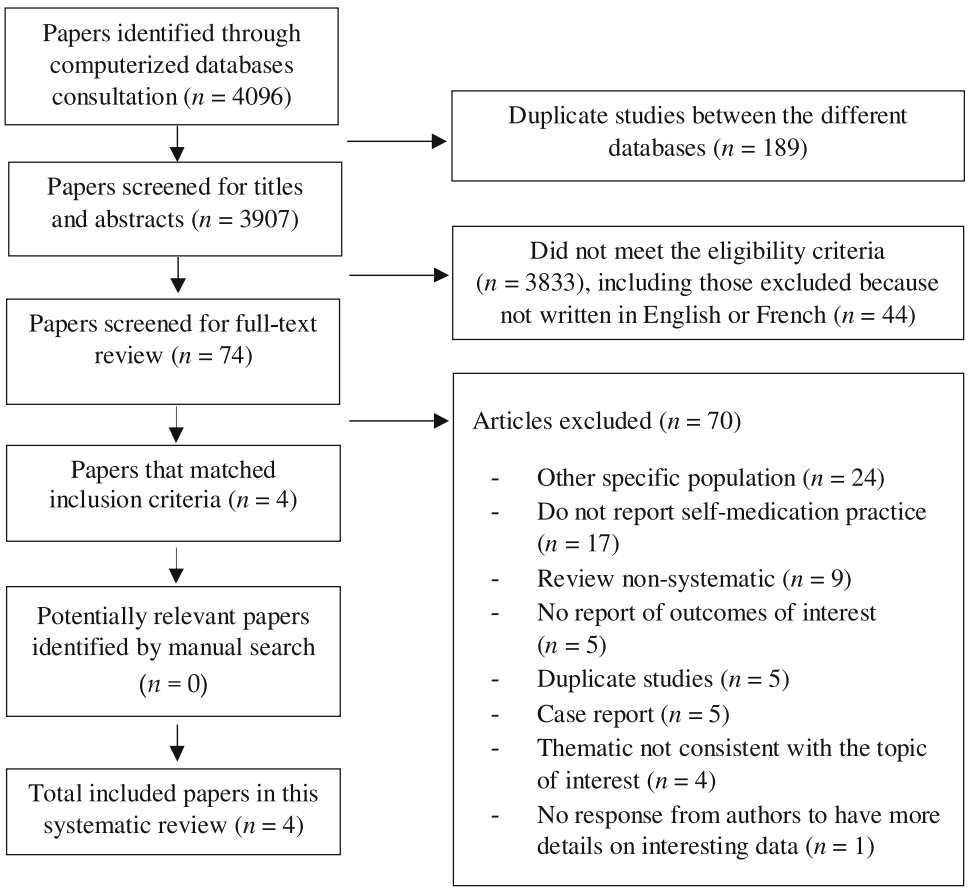

Fig. 1 Detailed literature search strategy

and abstract screening. The full texts of the remaining 74 articles were reviewed following strict eligibility criteria. This review led to further elimination of 70 publications. The manual search of the reference lists did not identify other relevant papers. Finally, our systematic review focused on four studies [14–17]. In January 2017, an update was performed and yielded 455 articles. All titles and abstracts were reviewed but none of these articles met the inclusion criteria and it was therefore deemed not relevant to include this search in the present research.

3.2 Study Characteristics

General information on the four selected studies [14–17] is included in Table 2. These papers were all published between 1997 and 2009 and the sample size ranged from 176 [16] to 1059 [17] subjects. Most studies were conducted in America [15–17] and used a cross-sectional design; one, a prospective cohort study, was performed in Europe (France) [14]. For studies with a cross-sectional design [15–17], the recall period for the outcomes of interest varied from 2 weeks [17] to 1 year [16].

Regarding the evaluation of self-medication, the authors did not use the same definition. Only one study [14] defined this term as the self-administration of not only OTC products but also formerly prescribed drugs (without guidance from a physician), while the other studies [15–17] only focused on OTC products. Moreover, one study [16] targeted self-medication products consumed only to treat sleep disorders.

As indicated in Table 1, we decided to consider all adverse and unwanted health events related to self-medication as the outcome. Of the included studies, three concentrated on ADRs [14, 15] and side effects [16], and one [17] reported on hospitalizations and emergency room visits. These outcomes were typically self-reported by the subjects [15–17] except for in the cohort study [14], in which ADRs were evaluated by physicians.

3.3 Risk of Bias in Individual Studies

A detailed report of the quality assessment of the three studies with a cross-sectional design [15–17] is available in Table 3. Globally, we observed a high or medium risk of

Table 2 General characteristics of included studies

Study	Sample size	Study design	Sociodemographic characteristics		Recall period	Definition of self-medication	Outcomes
			Country	Mean age and sex ratio			
Olivier et al. [14]	789	Prospective cohort study (follow-up: 4 non-consecutive weeks)	France	Patients with ADRs: 80.41 ± 8.50 years (range: 66–100) Women: 59.1% Patients without ADRs: 80.08 ± 8.29 years (range: 65–100) Women: 55.0%	Not applicable	Over-the-counter products and prescription-only medicines taken without medical advice	ADRs identified by physicians
Balbuena et al. [15]	245	Cross-sectional	Mexico	73.4 ± 8.0 years Women: 62.0%	30 days	All remedies taken on the own initiative of the individuals (i.e., not prescribed)	Self-report of ADRs, by asking each subject to name any potential unwanted effects associated with his/her medication
Sproule et al. [16]	176	Cross-sectional	Canada	74.0 ± 7.0 years Women: 59.0%	1 year	Any product that could be purchased in a pharmacy or health food store without a physician's prescription	Self-report of side effects of drugs
Stoehr et al. [17]	1059	Cross-sectional	Canada	74.5 ± 5.5 years (range: 66–97) Women: 57.3%	2 weeks	Over-the-counter products	Self-report of hospitalizations (during past 6 months) and emergency rooms visits (during the past year)

ADRs adverse drug reactions

Table 3 Quality assessment of the three cross-sectional studies using the Joanna Briggs Institute critical appraisal tool [13]

Domains	Balbuena et al. [15]	Sproule et al. [16]	Stoehr et al. [17]
1. Were the criteria for inclusion in the sample clearly defined?	Yes	Yes	Yes
2. Were the study subjects and the setting described in detail?	Yes	Yes	Yes
3. Was the exposure measured in a valid and reliable way?	No	No	No
4. Were objective, standard criteria used for measurement of the condition?	No	No	No
5. Were confounding factors identified?	Yes	No	No
6. Were strategies to deal with confounding factors stated?	Yes	No	No
7. Were the outcomes measured in a valid and reliable way?	No	No	No
8. Was appropriate statistical analysis used?	Yes	Yes	Yes
Sum of "Yes"	5	3	3
Risk of bias	Medium	High	High

bias in each of study. A better level of quality and a low risk of bias are observed in the longitudinal research [14]. For this specific study, strengths are indeed reflected in all areas of interest, except in the way of measuring exposure and outcomes (results not shown in detail).

3.4 Most Consumed Self-Medication Products

The most frequently consumed products were non-steroidal anti-inflammatory drugs (NSAIDs) and analgesics [14, 15, 17]. It is also worth noting the emphasis on the self-administration of vitamin and mineral supplements by the elderly [15–17]. The prospective cohort study [14] also focused on the re-use of formerly prescribed drugs.

3.5 Prevalence and Incidence of Adverse Drug Reactions Related to Self-Medication

One article [15] mentioned a 26.7% prevalence of ADRs among older people based on self-reported use of self-medication. In a second paper [16], a 75% prevalence of side effects of OTC products was reported by elders. The prospective study [14] showed an incidence of observed ADRs to be 4.5% among self-medicated elders. That study also found that self-medication behaviors were more common in older patients with ADRs than those without ADRs (19.7 vs. 10.4%, $p = 0.04$). The type of side effects and ADRs varied, but gastrointestinal disorders were the most frequent [14, 15].

3.6 Associations Between Self-Medication Practices and Negative Health Outcomes

From the available data [17] we recalculated the cross-sectional associations between the consumption of OTC drugs and hospitalization (unadjusted odds ratio [OR]: 1.41, 95% confidence interval [CI] 0.84–2.38, $p = 0.18$) and emergency room visits (unadjusted OR: 1.36, 95% CI 0.80–2.30, $p = 0.25$). Additionally, the multivariate analysis in the cohort study [14] showed that self-medication was significantly associated with ADRs (OR: 2.34, 95% CI 1.18–4.66, $p = 0.01$).

4 Discussion

The purpose of this systematic review was to obtain an overview of the scientific studies assessing the adverse health events related to self-medication practices in the elderly. In total, only four articles on this issue were selected. In our analysis, most studies were excluded because they did not focus on the elderly population. However, older persons seem to have a particular susceptibility to self-medicate [11], and this susceptibility requires close attention.

Primarily, we have shown that the three cross-sectional studies included in our analysis were considered to present a medium or high risk of bias and are therefore not of excellent quality. However, the topics of interest (i.e., the practice of self-medication and adverse health events) are difficult to evaluate in a totally objective manner and these articles have the merit of bringing relevant observational data to the scientific literature in order to provide an overview of the issue. In more detail, these studies, except one, used a cross-sectional design [15–17]. Therefore, the causal relationships between self-medication and the negative health outcomes remain difficult to determine. In particular, there could be a recall bias (one study [17] used a recall period of 1 year, which seems to be too long, especially in a population of elderly subjects). Additionally, all of the data in these cross-sectional studies were self-reported. This could introduce a social desirability bias: subjects likely tended to not talk about their self-medication behavior and its adverse events with health professionals. The longitudinal study [14] had an advantage over the others: the authors were able to establish the adjusted risk of ADRs associated with self-medication

practices in the elderly. In two of the four included studies [16, 17], potential confounding factors such as age, sex, educational level, and number of co-morbidities or medications are not taken into account. The highlight of an association between self-medication and adverse health events is therefore not evident.

In general, we noticed a great heterogeneity in the definition and assessment of not only self-medication but also its adverse health events. There was substantial diversity between the studies, their objectives, and their methodology, making comparisons difficult. This underlines the need for a standard and accepted definition of self-medication as well as for the assessment of its related adverse health events.

Another finding was that the main adverse drug events reported in the included studies were gastrointestinal disorders. This is in line with the results of studies conducted in the general population [18, 19]. Regarding the consumed products, three of four studies [15–17] underlined the self-administration of vitamins and mineral supplements. These types of products are not always safe and may lead to adverse health outcomes. Another study [14] reported on the consumption of formerly prescribed drugs, which is a frequent but undervalued practice that can clearly generate health problems. Furthermore, we observed a broad consumption of NSAIDs and analgesics, which are routine drugs but not devoid of health hazards. We can also speculate that these products can often cause ADRs precisely because they are self-consumed in addition to being prescribed [20, 21]. Indeed, it appears that 44% of consumers self-administer these drugs more than the recommended dosage [22]. Polypharmacy in the elderly, including the (inadequate) use of prescribed medications, OTC medications or vitamin supplements, is also an important concern. The risk of ADRs related to polypharmacy is significantly increased and may reach 82% when seven or more medications are consumed [23]. It is therefore essential that healthcare providers pay great attention to this phenomenon and evaluate it as part of their clinical routine, without neglecting the fact that self-medication practices are an integral part of this problem.

Regarding the reported adverse health outcomes, the included studies showed ADR rates of 4.5% [14] and 26.7% [15] as well as a 75% rate of side effects [16]. In studies conducted within the general population [2, 18, 19], the rates of ADRs due to self-medication practices ranged from 1.3 to 3.9%. In particular, two studies demonstrated that hospitalizations due to ADR-related problems were more common among older people than in younger populations [24, 25]. Adverse health events thus seem to be more numerous among self-medicating elders and, given the particular vulnerability of the older individuals to these events, these findings highlight the importance of being aware of such risks. Furthermore, we can also assume that the true prevalence of adverse events is underestimated [26, 27] and that the phenomenon is more extensive than observed. This underestimation may occur because of the cross-sectional nature of the studies, which could imply a memory bias with under-reporting, but also because symptoms of ADRs in this age group can likely be attributed to chronic diseases or, more generally, to advanced age. It should be noted, however, that the frequency and severity of ADRs appear to be lower when related to self-medication than when related to prescribed drugs [18].

We were also interested in the associations between self-medication and health events. One study [17] showed no significant associations between the self-medication behavior of older subjects and hospitalizations or visits to the emergency room. However, the recall periods for hospital admissions were quite long (up to 1 year) and were not consistent with the recall period of OTC consumption (2 weeks). Nonetheless, a significant association was well-defined within the longitudinal study [14]: self-medicated elderly had a higher risk (increased 2.34-fold) of experiencing ADRs.

Finally, from a public health point of view, it should also be noted that non-responsible self-medication practices involve significant healthcare costs, particularly with the cost of related-ADRs representing a real economic burden [28]. Indeed, individuals are exposed to several risks when self-medicating (i.e., delayed diagnosis, misdiagnosis, adverse health effects, drug interactions) that can result in a waste of public resources [3].

Some limitations of our present systematic review should be addressed and must lead to a reflective interpretation. Indeed, our financial resources, despite all our efforts, did not allow us to investigate certain databases (e.g., EMBASE) or articles (i.e., those not written in English or French). Nevertheless, our analysis allowed us to highlight the fact that self-medication-related adverse events among the elderly are a public health concern that remains scarcely evaluated and mentioned in the scientific literature. To our knowledge, this is the first systematic review on this topic. However, we employed a broad view of adverse health events related to self-medication, and this approach did not facilitate interpretation and did not allow for a synthesized and homogeneous analysis. Nevertheless, this type of investigation is also complicated by the lack of consensus regarding the definition of 'self-medication', demonstrating the need to establish a universal definition.

5 Conclusion

Our review demonstrates that there is clearly a need for further prospective pharmaco-epidemiological studies using a consensual definition and assessment of self-

medication and its related adverse events in the elderly. This would allow assessment of the extent and the risk–benefit balance of this practice with the aim of raising awareness regarding this problem.

Compliance with Ethical Standards

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Conflict of interest Médéa Locquet, Germain Honvo, Véronique Rabenda, Thierry Van Hees, Jean Petermans, Jean-Yves Reginster, and Olivier Bruyère declare that they have no conflicts of interest relevant to the content of this systematic review.

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