

Tobacco use among the elderly: a systematic review and meta-analysis

Uso de tabaco entre idosos: revisão sistemática e meta-análise

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ABSTRACT

The aim of this study was to combine the results of identified surveys on the prevalence of tobacco use in old age to estimate world prevalence of tobacco use and possible factors related to such behavior among the elderly. The literature search included electronic databases such as MEDLINE, LILACS, and Biological Abstracts, hand-searching of specialist journals and cited reference searches. The combined global prevalence was estimated using the random effects model. The total number of

elderly subjects included in all surveys was 140,058, with data available from all the continents. Overall prevalence of tobacco use was 13% in both genders (22% male and 8% female). The prevalence rates were heterogeneous among surveys and were associated with smoking definition, questionnaire application, and country economic status. Few epidemiological studies assessed tobacco use among the elderly. A higher prevalence rate of tobacco use in males who live in higher income countries could be found, although additional evidence regarding elderly samples is still required.

Tobacco; Smoking; Aged

RESUMO

O objetivo deste estudo foi combinar os resultados de pesquisas identificadas sobre a prevalência do tabagismo em idosos, para estimar sua prevalência mundial e possíveis fatores relacionados a este tipo de comportamento entre eles. A revisão da literatura incluiu busca nas bases de dados eletrônicas como MEDLINE, LILACS e Biological Abstracts, busca manual em jornais especializados e nas referências citadas. A prevalência global combinada foi estimada usando-se o modelo de efeitos randômicos. O número total de idosos incluídos em todos os levantamentos foi 140.058, com dados disponíveis em todos os continentes. A prevalência de tabagismo foi de 13% em ambos os sexos (22% homens e 8% mulheres). As taxas de prevalência foram heterogêneas e estiveram associadas com a definição de tabagismo, aplicação do questionário e com a economia de cada país. A maior taxa de prevalência foi encontrada entre idosos do sexo masculino que vivem em países de renda mais alta.

Tabaco; Tabagismo; Idoso

Introduction

Tobacco use is responsible for almost 10,000 deaths each day and approximately 4.9 million deaths per year worldwide ¹. Cigarette smoking has been linked to several diseases such as respiratory and ischemic heart diseases, stroke, lung, upper respiratory and digestive tract cancers, and peptic ulcer ¹. This habit may contribute to the morbidity and disability associated with many of those illnesses, and it results in a burden of US\$ 157 billion in health-related economic costs in the United States ².

Smoking is now recognized as a major public health problem also among the elderly. Risk of death among older smokers is higher than among their nonsmoking counterparts. Morbidity and mortality from cancer, stroke, cardiovascular, and respiratory diseases are also higher among elderly smokers^{3,4}. Some data suggest that, as a group, the elderly not only smoke for a longer period of time than younger smokers, but are also less aware of the potential harms of tobacco use. As a result, they are more resistant to quit smoking, do not report a greater number of quitting attempts or methods, and tend not only to underestimate the risks but also to overestimate the benefits of smoking^{3,5}. Among the barriers that impact the success of smoking cessation attempts, the elderly have high rates of nicotine dependence⁶ and are more likely to be dealing with life stresses and social isolation³.

The need to gather information about tobacco consumption in vulnerable groups of individuals was previously reinforced as an important step for the development of appropriate intervention strategies to cessation⁷. Factors affecting tobacco use and its prevalence among the elderly are not completely understood. Understanding the values, beliefs, attitudes, and behaviors in relation to smoking among older individuals may help in the development of strategies that seek to reduce the associated morbidity and mortality. Consequently, the aim of this paper is to evaluate the prevalence of tobacco use among the elderly and to identify factors that are associated with variation in prevalence across studies.

Method

Search strategy

In order to gather as many studies as possible on the issue, the strategy for data collection aimed to identify papers which presented broad definitions of tobacco use, either everyday or some day use, regardless of the amount of smoking. The following sources were searched looking for cross-sectional studies: (i) electronic databases (MEDLINE, LILACS, and Biological Abstracts); (ii) hand-searching of specialist journals (journals most likely to contain surveys in this area have been searched such as *Am J Public Health*, *Addiction*, *Tob Control*, *MMWR Morb Mortal Wkly Rep*, and *Prev Med*); and (iii) cited reference searches.

As a first step, the search strategy used the following terms: (tobacco OR smok* OR cigarette) AND (elder* OR aged OR old) AND (epidemiology OR survey OR prevalence), which identified only three studies on the frequency of tobacco use in the elderly. In an attempt to find more studies, we performed a second search with the terms (tobacco OR smok* OR cigarette) AND (epidemiology OR survey OR prevalence).

Inclusion/exclusion criteria

Of the 1,400 papers found, 160 abstracts were reviewed and 48 studies were included. We identified three epidemiological studies dealing with tobacco use among community-dwelling elderly^{9,10,11}. The other 45 studies were carried out in community-living adults which included elderly samples. All these data were further checked reading the full paper.

[Table 1](#) outlines the methodological characteristics of the included surveys.

Data were available from surveys carried out in all the continents and both north and south hemispheres. The adult population was largely assessed in all surveys, and the elderly subjects represented a small proportion of them. There was a wide variation in the number of participants aged 60 years and older included in the surveys, ranging from 52¹² to 40,146 subjects¹³, and the total number of elderly subjects included in all surveys was 140,058 (median = 1,233).

Questionnaire application was not homogeneous. Three studies were via telephone calls^{12,14,15}; three studies performed interviews both via telephone calls and personally in the household^{16,17,18}. Respondents were invited to attend a health center where they were interviewed in one survey¹⁹, and in another one the questionnaire was either completed in a health center or sent to the respondents' houses²⁰. The other 37 studies were solely conducted in household.

Information on adult current cigarette use was provided by the interviewee, except in nine surveys that allowed for proxy responses^{11,13,18,21,22,23,24,25,26}.

Tobacco users were classified as *smokers*, *regular smokers*, *tobacco smokers*, *cigarette smokers*, *current smokers*, and *hardcore and heavy smokers*.

Definition of *smokers* were: (i) "*those smoking every day*"²⁷; (ii) "*subjects who smoke daily or sometimes at the time of examination*"^{28,29,30,31}; and (iii) "*smoking one or more cigarettes weekly for 6 months or more before the survey*"³².

Definition of *regular smokers* included those people who: (i) "*reported that they currently smoke daily or occasionally*"³³; (ii) "*those adults who smoked at least on a weekly basis*"³⁴; (iii) *Cigarette Smokers Regular light smokers* - "*those who smoked less than one packet a day*"²².

Current smokers were defined as those: (i) "*smoking at least one cigarette each day*"^{19,35}; (ii) "*smoking one or more cigarettes daily for 6 months or more before the survey*"^{36,37}; (iii) "*smoking tobacco products at the time of the survey*"^{15,38,39,40,41,42}; (iv) "*having smoked at least 100 cigarettes in one's lifetime and currently smoke every day or some days or continue to smoke regularly or were still smoking daily at the time of the interview*"^{10,11,12,14,17,26,43,44,45,46,47}; (v) individuals who gave positive response to the questions "*Have you ever*

smoked regularly?", and *"Do you currently smoke?"*, or *"Do you still smoke?"*⁴⁸; (vi) *"those who had smoked in the past month"*²¹;

(vii) *"respondents who reported that they had smoked in the three months prior to the survey"*⁴⁹. Furthermore, some surveys considered *current smokers* as: (i) *regular or daily smokers* - *"who at the time of the interview smoked at least one cigarette per day"*; (ii) *occasional smokers* - *"who at the time of interview did not smoke every day"*^{49,50}; (iii) *ever smokers* - *"more than 100 cigarettes in their lifetime"*⁵¹.

Heavy smokers were defined as: (i) *"smokers with a daily consumption of more than 14g of tobacco"*²⁸; (ii) *"individuals who consumed more than 25 cigarettes per day"*⁵¹; (iii) *"those currently smoking \geq 15 cigarettes per day"*²⁵. Definition of *hardcore smokers* comprised people who answered: (i) *"less than a day without cigarettes in the past five years"*⁷; (ii) *"no attempt to give up smoking in the past 12 months"*⁷; (iii) *no to "Do you want to give up smoking altogether?"*⁷; (iv) *"no intention to give up smoking"*⁷; and (v) *Regular heavy smokers* - *"those who smoked one packet or more daily"*²².

Some other definitions that were found included: (i) *cigarette smoking* - self-reported daily use of these products⁵²; (ii) *tobacco smokers* - *"people who answered 'yes' to the question of smoking tobacco"*¹³; (iii) *occasional smokers* - *"those who smoked less than one cigarette a day"*²². In some studies there was no definition of smoking status and smokers were classified as current smokers^{20,23,53,54}. Data derived from these less specific definitions were analyzed as *"No definition"*, therefore separately from the better delineated definitions listed above.

In three surveys, definition of tobacco use included local tobacco products such as *beedies*⁴⁴, *toombak*⁵⁵, *waterpipe*²², and one included other forms of tobacco use such as *chewing of tobacco*¹³.

Data on local and non-inhaled tobacco products were not included for analysis.

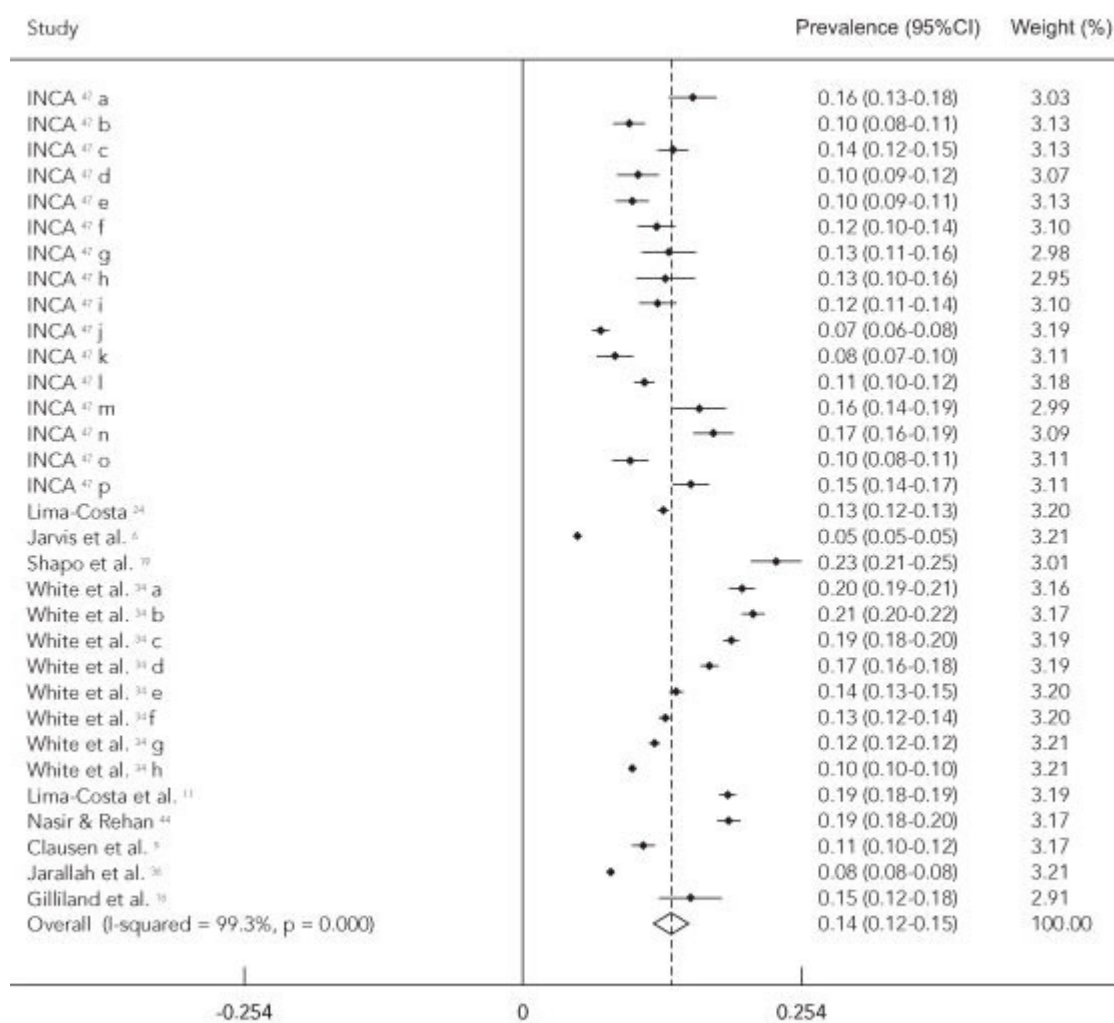
Overall prevalence of tobacco use was higher for men. Smoking prevalence among males was highest in Indonesia (84.5%)²¹, and lowest in Australia (11%)³⁴. Among females, the smoking prevalence was highest in Tonga (26.1%)⁴⁹, and lowest in Kazakhstan (0.4%)³⁵ and Bulgaria (0%)²⁷. Some studies described prevalence rates for both genders and rates varied from 6.8% in the United States¹⁷ to 63% in Copenhagen, Denmark²⁸.

Meta-analysis results can be seen in [Figures 1, 2](#) and [3](#). A statistical procedure confirmed the initial assumption of a greater prevalence in men, with an overall prevalence of 13.5% (95%CI: 12.0-15.1). Smoking prevalence rates by gender were 22.5% (17.0-28.1) and 8.7% (6.8-10.6) for men and women, respectively. The chi-squared test for homogeneity and I-

squared statistic showed an important heterogeneity of the prevalence rates among the studies.

Figure 1

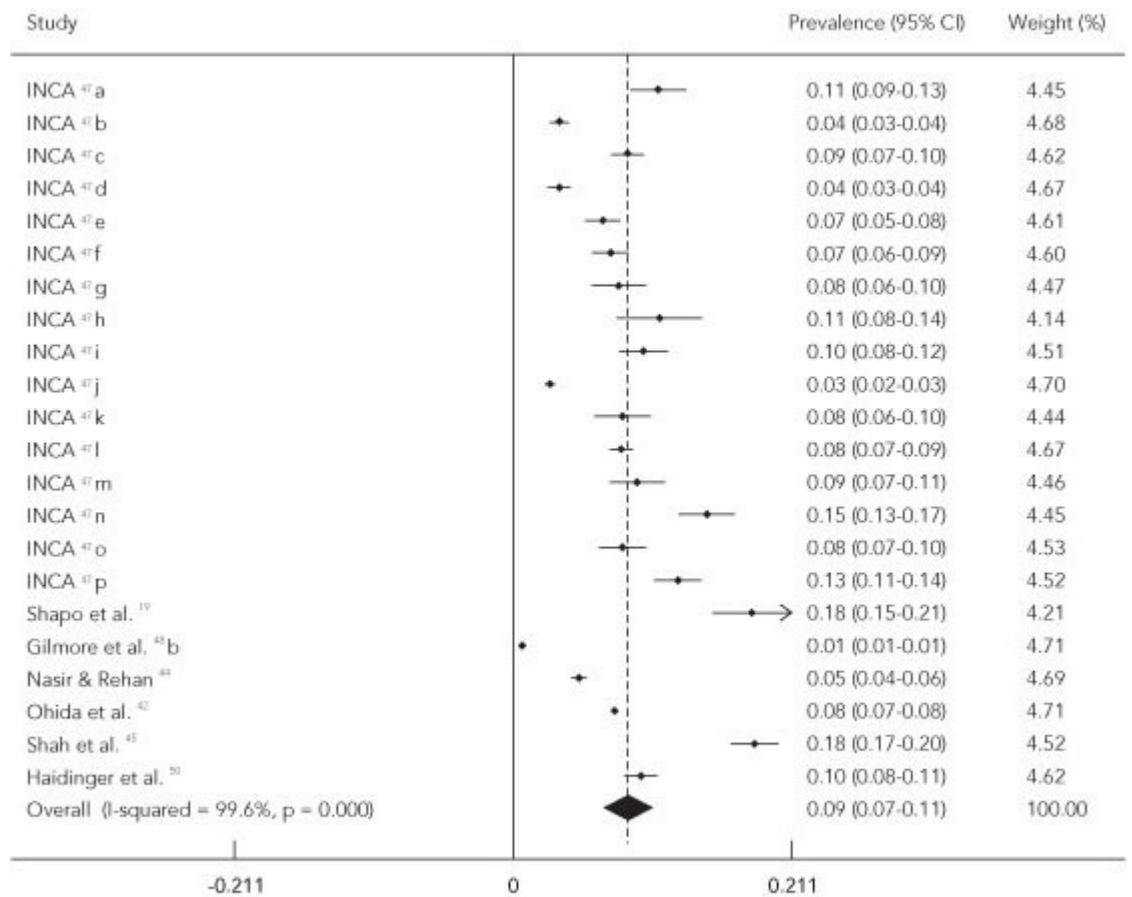
Smoking prevalence rates among the elderly (both sexes).



Note: weights are from random effects analysis.

Figure 3

Smoking prevalence rates among the elderly (female).



Note: weights are from random effects analysis.

Aiming to detect which variables might be responsible for that variability we carried out a meta-regression including: smoking definition, method of questionnaire application (household, telephone), country economic status, and continent. Prevalence varied by age group, with a general tendency of decreasing prevalence rates with advancing age. As studies used different age categories, this hypothesis could not be tested. Some surveys considered as elderly those aged 55-years and older, 60-years and older, 65-years and older and 70-years and older, whereas others used categories of age in more than two groups, 61-65 years, 66-70 years, > 70 years; 55-69; 60-69, ≥ 70 ; 65-74, ≥ 75 ; 50-88 years.

Smoking definition was associated with prevalence variability. Smoking definition according to the Centers for Disease Control and Prevention (CDC) criteria (having smoked at least 100 cigarettes in one's lifetime and currently smoke every day or

some days) was considered the more accurate characterization⁵⁶. The CDC criteria yielded a prevalence which was 22% lower in men and 10% lower in women as compared to less accurate definitions. However, CDC studies showed a higher prevalence than those which did not attempt to define tobacco use among women (8% increase). Questionnaire application (telephone/face-to-face/mailed) also interfered on prevalence rates. Although statistical significance was borderline ($p = 0.08$), the prevalence rates in men were higher in surveys conducted via telephone calls than in face to face surveys. There was also a trend in enhancing smoking prevalence among women in surveys conducted in a health center, 10% higher than household face-to-face surveys.

Demographic factors such as continent and country economy status also had a statistically significant impact on smoking prevalence rates among men. High income countries have a 10% higher prevalence rate than lower middle income countries. Taking Latin America as a reference, there was a 10% increase in prevalence rates in Asia and, a 19% increase in North America, whereas Europe showed a 14% increase ([Table 2](#)).

Discussion

This review identified a large number of surveys on tobacco use, but only three of them were specifically suited to search health and socio-demographic factors in the elderly population. Almost all surveys included elderly in the total adult sample and used questionnaires tailored to the adult population.

The meta-analysis suggests a higher smoking prevalence among men. Gender differences in tobacco use are well known among adults⁵⁷, although recent cohorts have shown an increased use in young women⁵⁸. Such estimates imply that in the future tobacco use may increase among elderly women, reproducing the trend observed in young cohorts.

Concerning age groups, the initial assumption of a decreasing prevalence with advanced age could not be evaluated properly in this study due to methodological issues. Despite the fact that there was a trend in decreasing prevalence rates among the oldest elderly, this could not be established because of the variability in definitions of age groups. Lower prevalence among the very oldest could be explained by selective survival probabilities (smokers die earlier) or by birth cohort effect. Cross-sectional studies do not allow for discrimination between these two possibilities.

The observed heterogeneity in prevalence rates among surveys could be partially explained by different smoking definitions, questionnaire application strategies, and country economic status. Prevalence rates were related to the accuracy in measures of tobacco use. Less accurate definitions produced

higher prevalence rates, since they included occasional, daily, and heavy smokers without distinction. Nevertheless, there was an unexpected finding of lower prevalence rates related to studies that classified tobacco use as "no definition" as compared to those with more accurate definitions. This could be caused by chance as only one study categorized smokers as "no definition", and the reported prevalence was very low (0.7%)⁴⁸.

Several studies show that the methodology of questionnaire application (telephone/face-to-face) does not affect smoking prevalence rates among surveys conducted in the community^{59,60,61}. However, contrasting results from recent follow-up studies suggest that significant differences regarding socio-demographic variables arise among smokers who gave answers by telephone and by mailing^{62,63}. Indeed, this is a very important issue when studying community-dwelling elderly, given that this population usually has hearing, visual, and movement impairments that may complicate proper data collection which use these means.

Albeit not statistically significant, this study found a higher prevalence among surveys carried out in health centers and among those using questionnaires answered by telephone. Cross-sectional surveys in health centers are prone to a selection bias. Elderly people who attend senior citizen centers may be in poorer health conditions⁶⁴ and are more likely to be engaged in unhealthy behaviors, possibly explaining enhanced prevalence rates of smoking found in these facilities. Telephone interviews also produced a non significant statistical increase in smoking prevalence, contradicting an initial postulation that elderly subjects would be less suitable to answer telephone interviews and to give proper answers to the questions on tobacco use. Hence, such a result suggests that telephone interviews can be an accurate way of measuring tobacco use among the elderly, since differences found were small, not statistically significant, and were more likely to over- rather than under-estimate prevalence rates.

Information on tobacco use was mostly obtained by self-reporting, whereas proxy responses were allowed in nine surveys. The impact of proxy responses and the validity of self-reported smoking on estimates of tobacco use among the elderly remain uncertain. Proxy responses might under-estimate smoking prevalence. On the other hand, self-reported responses are considered a safe and economic measure of tobacco use in population studies⁶⁵. The present results suggest that self-reporting screening is also a safe measure of tobacco use among the elderly, since there was no difference in prevalence rates of proxy responses as compared to those obtained by the former method.

There is also evidence that elderly people living in countries with better socio-economic conditions have higher prevalence rates of tobacco use than those living in under-developed countries. Countries and continents which include more developed nations were the most likely regions to present higher prevalence rates. This result contrasts with recent findings suggesting that low

socio-economic conditions are related with tobacco use, both at individual^{13,33,37,38,46,54,66} and domiciliary level^{66,67}. A possible explanation for such a finding is that rates of cigarette smoking in developed countries have decreased mainly among adults. Tobacco control activities usually focus on young adults, and as a result elderly people living in those countries may not be exposed to those educational programs. Tobacco use among future elderly cohorts may decrease following the trend observed in young cohorts.

A range of different factors precluded the conclusions on frequency of tobacco use among the elderly to be drawn as precisely as we wanted. These included variability in elderly sample size among surveys, study quality and design, heterogeneity in data collection such as differences in smoking definitions and inclusion of regional tobacco products, classification of elderly according to age ranges, and limitations from meta-analysis methodology.

Limitations of this study include those common to all meta-analysis research, since this procedure can be affected by the methodological quality of the original studies. Furthermore, sample size and response rates can represent a selection bias when calculating smoking prevalence, since smokers are less prone to answer questions on tobacco use⁶³. In almost all selected surveys, response rates in the elderly had not been described routinely. Also, not all the countries had elderly samples equally represented and cultural aspects that may affect tobacco use definitions and the methodology of data gathering might vary between regions and countries studied, becoming a confounder in the causal relationship between country and smoking prevalence. Finally, we must consider that other databases such as Embase, Scopus, PsychLit books, Masters or PhD theses were not included in our research strategy.

Thus, the conclusions on this meta-analysis can not be generalized as representative of a pattern of smoking behavior among elderly subjects worldwide.

Conclusion

Tobacco use among the elderly is an important and potentially preventable health problem. However, few epidemiological studies have assessed rates of tobacco consumption among the aged so far. Additional evidence regarding elderly samples, using questionnaires tailored to investigate their main health problems and socio-demographic distress factors is required. The methodology applied may impact on the results, more precise and strict definitions should be applied as they yield more reliable prevalence rates. Cultural and socio-economic factors contributing to the pattern of tobacco use among the elderly should be evaluated in future surveys. There is also a need of follow-up studies to prospectively evaluate tobacco use

patterns among the elderly. In summary, our study is able to conclude that higher prevalence rates of tobacco use are found in males, although there is a possible trend for increasing tobacco use among elderly females, as observed in younger cohorts.

Contributors

V. Marinho reviewed the literature, selected the manuscripts, participated in the data analysis, and in the writing of the article. J. Laks participated in the selection of the manuscripts and in the writing of the article. E. S. F. Coutinho performed the statistical analyses and contributed to the discussion of the data in the manuscript. S. L. Blay designed the study and participated in all the steps, from the elaboration of the protocol to the final review of the manuscript.

Conflicting interests

Dr. Valeska Marinho has been working as a medical manager at GlaxoSmithKline Brazil.

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