Cogitare Enferm. 2016 Apr/jun; 21(2): 01-10

Revision

IMPACT OF ASBESTOS EXPOSURE ON THE HEALTH OF THE ADULT POPULATION: AN INTEGRATIVE REVIEW

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ABSTRACT: The objective of this study was to identify the impact of asbestos exposure on the health of the adult population in scientific publications. An integrative literature review was carried out in health databases in the period from 2005 to 2015. Fifteen studies were selected.The impact of asbestos exposure on the adult populationwas observed inthe onset of diseases such as malignant mesothelioma, asbestosis, and lung cancer. Mortality due to mesothelioma in workershad a significant prevalence for the study. Mortality ratesare alarming, considering that the therapeutic possibilities are limited. The impact of asbestos exposure surpasses biological aspects, bringing significant psycho-emotional changes to the health of the population. Therefore, it is important to discuss the asbestos impact on adult health, primarily in worker's health, regarding the need for banning its use in countries that still use it in industrial and commercial scale.
DESCRIPTORS: Asbestos; Mesothelioma; Adults; Occupational risks; Worker's health.

IMPACTO DA EXPOSIÇÃO AO AMIANTO NA SAÚDE DA POPULAÇÃO ADULTA: REVISÃO INTEGRATIVA

RESUMO: Objetivou-se identificar o impacto da exposição ao amianto na saúde da população adulta, nas publicações científicas. Revisão Integrativa de literatura realizada em bases de dados na área da saúde no período de 2005 a 2015. Foram selecionados 15 estudos. Verificou-se o impacto da exposição ao amianto na população adulta com o adoecimento por mesotelioma maligno, asbestose, câncer de pulmão, entre outros; a mortalidade por mesotelioma em trabalhadores conferiu prevalência significativa para o estudo. A taxa mortalidade é preocupante, haja visto que as possibilidades terapêuticas são limitadas. O impacto do amianto ultrapassa os aspectos biológicos, trazendo alterações psicoemocionais significativas na saúde da população. Destaca-se a importância do debate sobre o impacto do amianto na saúde do adulto, principalmente no campo da saúde do trabalhador sobre a necessidade do banimento de seu uso nos países que o mantém em escala industrial e comercial.
DESCRITORES: Asbestos; Mesotelioma; Adultos; Risco ocupacional; Saúde do trabalhador.

IMPACTO DE LA EXPOSICIÓN AL AMIANTO EN LA SALUD DE LA POBLACIÓN ADULTA: REVISIÓN INTEGRATIVA

RESUMEN: Se objetivó identificar el impacto de la exposición al amianto en la salud de la población adulta, en las publicaciones científicas. Revisión integrativa de literatura realizada en bases de datos del área de salud entre 2005 y 2015. Fueron seleccionados 15 estudios. Se verificó el impacto de exposición al amianto en población adulta con padecimiento de mesotelioma maligno, asbestosis, cáncer de pulmón, etc.; la mortalidad por mesotelioma en trabajadores le confirió prevalencia significativa al estudio. La tasa de mortalidad es preocupante, visto que las posibilidades terapéuticas son limitadas. El impacto del amianto sobrepasa los aspectos biológicos, provocando alteraciones psicoemocionales significativas en la salud de la población. Se destaca la importancia del debate sobre impacto del amianto en la salud del adulto, especialmente en el área de salud del trabajador, enfatizando la necesidad de la prohibición de su utilización en los países que lo mantienen en escala industrial y comercial.
DESCRIPTORES: Asbestos; Mesotelioma; Adultos; Riesgos Laborales; Salud Laboral.

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Received: 19/05/2016
Finalized: 03/06/2016

INTRODUCTION

Asbestos is a mineral that has been widely used worldwide over the decades, mostly between the 1950's and 1970's, for manufacturing products, such as: fiber-cement for water tanks, roof tiles, and automobile brake linings[1]. This mineral is classified into six types: serpentine (chrysotile – white asbestos), amphiboles (amosite, actinolite – brown asbestos), anthophyllite, crocidolite, and tremolite (blue asbestos)[2].

The first references of asbestos' harmful potential in humans occurred between the 1950s and 1960s[3-4], with the result of studies on the mechanisms of asbestos toxic effects on human health[5]. However, at the end of the 1970s, the International Agency for Research on Cancer (IARC), in partnership with the World Health Organization (WHO), confirmed that exposure to asbestos is carcinogenic to humans[2].

Exposure occurs by inhaling the fibers scattered into the air, especially in the workplace and the vicinities of factories that manipulate the mineral[6]. Thus, the occupational risk is a pressing concern, since the disease burden has a major impact on men, who work directly with asbestos[7-8] and with overall exposure time longer than 20 years[9].

All types of asbestos are harmful at any level of exposure[10], including the chrysotile, sold in many countries[11]. Studies indicate that diseases and cancer caused by the exposure lead the ranking, among them: lung cancer, pleural, peritoneal, and pericardial mesothelioma (rare and fatal cancer 80% associated with the exposure)[12]. Including also pleuropulmonary diseases, such as idiopathic pulmonary fibrosis[13] and asbestosis[14].

Even if the use of asbestos is discontinued today, the outbreak of diseases will continue for the next decades, due to the long period it takes for the first symptoms to manifest, denominated latency period[6], such as in the case of malignant mesothelioma[15]. As a result, exposure to asbestos has become a health emergency, due to imminent risks to the health of the adult population[16].

Therefore, the struggle for banning its use at any stage of the industrial process and from commercialized products has become a pressing need[10,17]. According to data from the International Ban Asbestos Secretariat (IBAS), asbestos was banned in 57 countries, whereas the largest producers and consumers are Russia, China, and Brazil[18].

The objective of this study was to identify, in scientific publications, the impact of asbestos exposure on the health of the adult population.

METHOD

A descriptive study was conducted, with an integrative review of the scientific literature on the asbestos' impact on health. This type of review allows the inclusion of experimental and non-experimental studies for the understanding of a phenomenon. It combines theoretical and empirical literature, including purposes, assumptions, concepts, reviews, theories, generating possibilities of sound analyses for collaborating with health knowledge[19].

In order to structure this review, six methodological steps were followed: i) selection of leading question for the review; ii) establishment of criteria for selecting samples; iii) presentation of the characteristics of primary research; iv) data analysis; v) interpretation of the results; and, vi) review presentation[19].

This study was guided by the leading question: What is the impact of asbestos exposure on the health of the adult population?

The criteria for sample selection were: scientific articles published in the national and international literature, including the topic, with texts fully available online, in indexed journals in electronic databases consulted from 2005 to 2015, in Portuguese, English, and Spanish. Articles that did not meet the proposed objective, the selection criteria, and review articles (integrative and systematic) were excluded.

The search for studies was carried out electronically in the following databases: Latin American and Caribbean Center on Health Sciences Information (LILACS), National Library of Medicine (PubMed), Medical Literature Analysis and Retrieval System On-Line (MEDLINE), and Scientific Electronic Library (SCIELO), in the period from February to March of 2016. MESH (Medical Subject Headings) descriptors used were: asbestos, mesothelioma, adults, exposure, risk occupational, health workers. The Boolean operator and was used for combining them (Table 1).

For data collection, the researchers created a tool aimed for ensuring all the relevant data and for minimizing transcription errors; including identification (authorship, year of publication, and country), study objective, design, participants, level of evidence, and outcome.

The level of evidence was classified according to the categorization provided by the Agency for Healthcare Research & Quality (AHRQ). The quality of the evidence is classified into seven levels: level I – meta-analysis and systematic review; level II – individual studies/ design; level III – evidence from quasi-experimental study; level IV – descriptive studies with qualitative approach; level V – case studies; level VI – descriptive studies; level VII – opinion of experts(20).

The selection of publications was carried out separately by two reviewers. The following flowchart presents the article selection process to compose the sample, based on the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) criteria (Figure 1).

Table 1 – Electronic search results in the researched databases. Curitiba, PR, Brazil, 2016

Descriptors	LILACS	MEDLINE	PubMed	SCIELO
Asbestos and exposure and adults	1	12	332	13
Mesothelioma and asbestos and occupational risk	0	74	87	0
Asbestos and health workers	0	26	160	16

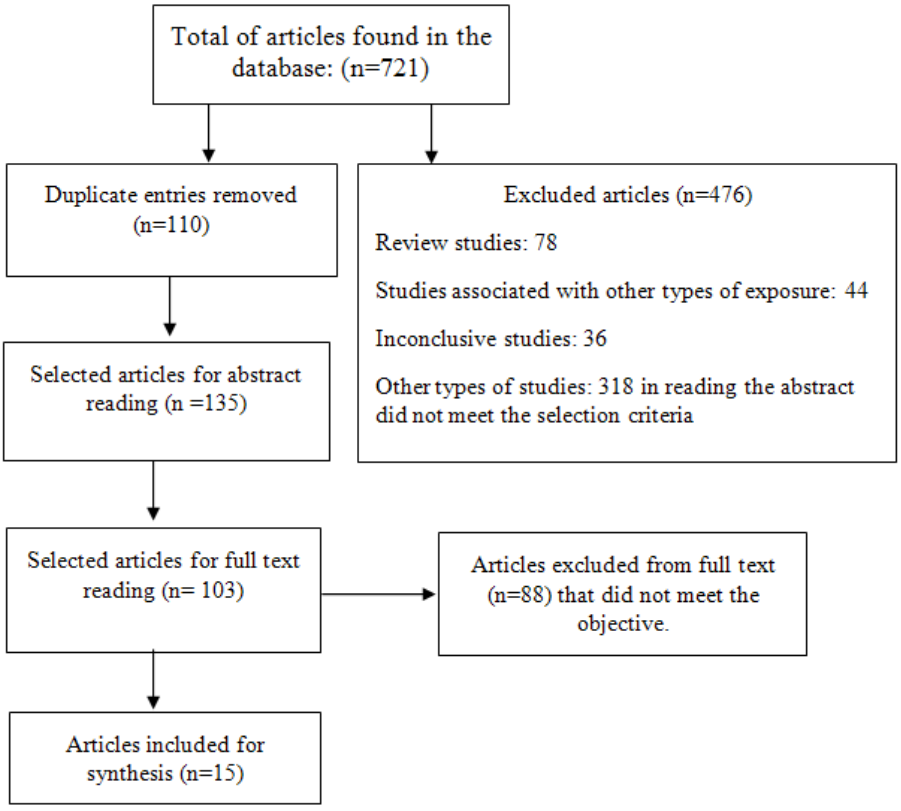

Figure 1 – Flowchart of the selection of scientific articles that composed the intensive review sample. Curitiba, PR, Brazil, 2016

RESULTS

The studies selected for synthesis were found in PubMed(14) and one in the SCIELO, composing the sample. As for the countries where the studies were published, five were from England/United Kingdom, four from the EUA, and one respectively from Argentina, Italy, Japan, Spain, Switzerland, and Brazil. As for the language, all studies were published in the English language, whereas two were also in Spanish, two in Italian, and one in Portuguese. The year of publication varied from 2005 to 2015, being one from 2015, four from 2013, two from 2012, three from 2011, one from 2010, one from 2007, and three from 2005. Regarding level of evidence, seven studies were level IV and eight were level VI. Table 2 shows the characterization of the studies/articles.

Table 2 - Characterization of the articles published in the period from 2005 to 2015, in PubMed and SCIELO. Curitiba, PR, Brazil, 2016.

Authorship, year and country of publication	Study objective and design N= participants	Level of evidence	Outcome
1. Abente GL, Gómez MG, Navarro AM, Navarro PF, Ramis R, Perez JG, et al [21]. 2013/England	Objective: to study pleural cancer mortality trends as an indicator of mesothelioma mortality predictions up to the year 2020. Design: Descriptive and prospective study.	VI	Mesothelioma and pleural cancer death trends work-related will continue to occur in Spain until at least 2040.
2. Zurbriggen R, Capone L.[22] 2013/Argentina	Objective: To describe clinical manifestations of pulmonary disease in steel industry workers. Design: Retrospective clinical study. N= 27	VI	Benign pathologies: 16 with pleural lesions 06 with asbestosis. Malignant pathologies: 4 with mesothelioma, and 1 with lung cancer
3. Menegozzo S, Comba P, Ferrante D, Santis M, Gorini G, Izzo F, et al.[23] 2011/Italy	Objective: To investigate the causes of mortality among men exposed to asbestos in an Italian cement factory. Design: Cohort study. N= 1247	IV	Cause of mortality: pneumoconiosis: 42 deaths asbestosis: 41 deaths pleural mesothelioma: 24 deaths lung cancer: 84 deaths peritoneal cancer: 9 deaths rectal cancer: 6 deaths
4. Wang X, Yano E, Lin S, Yu ITS, Lan Y, Tse LA,et al.[24] 2013/USA	Objective: To examine the relationship of mortality with lung cancer and other causes related to asbestos exposure. Design: Cohort study carried out in China. N= 1539	IV	Increase in lung cancer mortality: In 10 years 3.5 times In 20 years 5.3 times In the trend observed for non-malignant respiratory diseases, smokers showed higher all-cause mortality than non-smokers. A clear and direct relationship was observed in asbestos exposure for developing lung cancer associated with mortality.
5. Myogin T, Azuma K, Okumura J, Uchiyama I[25] 2012/Japan	Objective: To describe prospectively mesothelioma trend in mortality in Japan from 2003 to 2050. Design: Descriptive epidemiological study.	VI	Trend in mortality will continue to grow predicted for the years 2027 and it will reach up to 66,327 deaths between the years 2003 and 2050 in Japan
6. Pira E, Pelucchi C, Buffoni L, Palmas A, Turbiglio M, Negri E, et al.[26] 2005/United Kingdom	Objective: To analyze Cohort study data from 889 men and 1077 women who worked for at least one month in an asbestos company. Design: Cohort study. N= 889 men and 1077 women	IV	Among the Italian workers studied: 222 total deaths with pleural, peritoneal, and lung cancer, directly occupational work-related with asbestos for developing the respective diseases.

7. Darnton A, Hodgson J, Benson P, Coggon D.[27] 2012/England	Objective: To analyze data from mortality records by mesothelioma and asbestosis in Great Britain. Design: Descriptive study on data records.	VI	Mortality from 1991 to 2000: 33,751 by mesothelioma and 5,396 by asbestosis. Mortality rate by mesothelioma and asbestosis with progressive increase above 85 years of age. Mortality by mesothelioma is higher among men born between: 1939 – 1943. Mortality by asbestosis in people born between 1924 and 1938.
8. Pietro MA, Suess A, March JC, Danet A, Corral OP, Martin A.[28] 2011/Spain	Objective: To learn the opinions and expectations of workers from an asbestos factory in Uralita, with health problems associated with asbestos exposure. Design: Qualitative study using the focus group technique.	VI	Health problems of the employees: asbestosis, lung cancer, and mesothelioma. Opinions: discontinuation of health care, difficulty with correct diagnosis, bureaucracy, lack of specific care for family members. Expectations: recognition as work-related illness, payment of compensation, creation of specific health care unit with humanized treatment and technical tools with quality in the public health care system, and ongoing participation in programs and protocols.
9. Cole SR, Richardson DB, Haitão C, Naimi A.[29] 2013/USA	Objective: To analyze lung cancer mortality in workers exposed to asbestos in a factory in South Carolina/USA. Design: Cohort study. N= 3,002 participants.	IV	Mortality: 195 by lung cancer, highly associated with asbestos exposure.
10 Hodgson JT, McElvenny DM, Darnton AJ, Price MJ, Peto J.[30] 2005/England	Objective: To predict the burden of mesothelioma mortality prospectively in the Great Britain region. Design: Descriptive and prospective study.	VI	Forecast from 2011 to 2015: 2,450 deaths/ year; As of 2001: 65,000 deaths Between 1968 and 2050 Great Britain will have around 90,000 deaths by mesothelioma
11. Murlidhar V, Kanhere V.[31] 2005/USA	Objective: To identify workers who suffer from asbestosis in a company, evaluating their disabilities. Design: Case-control study. N= 181	IV	Workers in India:22% with asbestosis, up to 20 years of exposure to asbestos. Disabilities shown: 34% had late basal inspiratory rates; 82% had more than 80% of forced expiratory volume in the first second and forced vital capacity; 66%had forced vital capacity less than 80% of the predicted value, on radiology; 7% had pleural disease; 10% had both pleural and parenchymal disease.
12. Delgermaa V, Takahashi K, Park EK, Le GV, Hara T, Sarahan T.[32] 2011/Switzerland	Objective: To carry out descriptive analysis of death by mesothelioma reported worldwide from 1994 to 2008. Design: Descriptive study.	VI	In 83 countries there were 92,253 deaths by mesothelioma; Disease by location: pleura 41.3%; peritoneum 4.5%; pericardium 0.3%; non-specified location 43.1%.
13. Tan E, Warren N, Darnton AJ, Hodgson JT. [33] 2010/England	Objective: To evaluate prospectively the projection of mesothelioma in Great Britain. Design: Cohort study.	IV	Prospectively the estimated number of cases: 1.08 cases per one million inhabitants. Mortality among men projected for 2016: 2,040 deaths. Period from 1968 to 2050 estimated in91,000 deaths.

14.Ferrante D, Bertolotti M, Todesco A, Mirabelli D, Terracini B, Magnani C.[34] 2007/USA	Objective: To examine mortality incidence of mesothelioma in wives of workers exposed to asbestos. between 1907 and 1986 in Italy. Design: Cohort study.	IV	Mortality: 11 cases of pleural mesothelioma in wives exposed to asbestos in the home setting.
15. Clemente M, Reig-Botella A, Prados JC.[35] 2015/Brazil	Objective: To evaluate the psychosocial and mental health status of professionals in Spain affected by asbestos. Design: Cross-sectional study N= 110	VI	The psychosocial and mental health evaluation of the workers showed: mental disorders, obsessive-compulsive disorder, anxiety, depression, phobias, paranoia, psychosis, interpersonal sensitivity, hostility, global severity

DISCUSSION

The studies show the impact caused on the adult population exposed to asbestos. Approximately 200 million tons of asbestos are traded worldwide, and the processes starting in the mineral extraction up to the product manufacturing represent a threaten to the population's health[10].

The development of diseases by asbestos exposure had a prevalence for malignant mesothelioma and its mortality[12,16,18,21,23-25]. This pathology is related 80% to 90% to exposure to asbestos[12]. In a study conducted in Spain, in 2013, mortality rates caused by pleural cancer and mesothelioma have risen over the decades, with prevalence in men. Its commercialization was banned in the country in 2002[21].

The outbreak by mesothelioma in men is the result of work-related functions led by men; therefore, the burden of asbestos-related diseases is likely to prevail. Even a short-period of exposure is still considered a serious threat to health[9]. Men have a higher risk for developing diseases due to the exposure, since they are in the forefront of work activities in companies that manipulate asbestos[32].

Although asbestos has been banned in certain regions, mesothelioma cases continue prospectively, resulting from the latency period, which could reach 50 years after the end of exposure[36]. A good example is Japan that, in 2050, could reach 66,327 deaths, due to the latency period[25], corroborating a study in United Kingdom, which estimated approximately 90,000 deaths in that country for the same year[30].

Under this perspective, the link between mesothelioma and mortality shows a very close relationship in the studies[1,25,27,30,32-34]. The study conducted in 2010 in the United Kingdom estimated 2,040 cases of death by mesothelioma for the year of 2016, and in these regions deaths can occuruntil 2050[33]. There are studies being carried out for early detection and treatment aimed at better results in cases of mesothelioma[37]. Late diagnosis turns into poor prognosis, with a mean survival of 12 months[36].

Estimates of mesothelioma show no signs of declining. Higher incidence rates are described in some European countries (United Kingdom, Netherlands, Malta, Belgium) and in Oceania (Australia and New Zealand). It can also be noted that the underreporting of the disease determines the lack of worldwide data and does not allow risk awareness to be attributed to asbestos[38]. Thus, the cases of deaths by mesothelioma that occurred worldwide in the period from 94 to 2008 point to the underreporting of the disease as a problem and reveal that Brazil is one of the nations that show inconsistency in the notifications related to mesothelioma outbreaks[32]. This is alarming data, since Brazil currently holds the third position in the list of the largest producers of asbestos[17].

In Japan, asbestos commercialization was banned in 2004[19]; however, a study conducted in the country in 2012 estimated that between 2003 and 2050 there could be 66,327 deaths of individuals between the ages of 50 and 89 years[25]. In other regions, the average is 70 years and in the male population[24].

The risk of asbestos spreading to the population at large and not just confined to workers, including arising from natural phenomena, such as earthquakes that expose the asbestos present in construction material, is also considered a risk factor for the population[25]. Likewise, environmental risks are a cause for concern as well, because there is no safe level of exposure[39].

Another asbestos pathology related to mortality is asbestosis, with 5,396 deaths[27]. The disease is defined as diffuse interstitial pulmonary fibrosis, as a result of inhalation of asbestos fibers[40]. Bronco-pulmonary complications and morbidities, such as cardiac failure, are also related to asbestos exposure[27].

In Italy, a study with the aim to identify the mortality rate of 1,247 workers from a cement manufacturing plant located in Naples, showed an increased mortality due to respiratory diseases, mostly pneumoconiosis, asbestosis, lung cancer, peritoneal, and a small increase in rectal cancer[23]. The use of asbestos in that country was banned in 1992[18].

The nations that banned asbestos use are those with higher mortality rates worldwide, due to decades of use[41]. This occurred because the exportation and production of materials with asbestos increased, especially during the post-war period, leading to the economic growth of several countries[21,25].

In Spain, workers from a steel company, directly and indirectly exposed to chrysotile asbestos, with working hours ranging from 8 to 14 hours per day, and an average of 21 years of exposure, fell ill with asbestosis, pleural plaques, mesothelioma, and lung cancer, with prevalence in men and mean age of 65 years[22].

Chrysotile is responsible for more than 90% of asbestos used worldwide[42], with asbestosis and associated cancers, such as: lung, larynx, ovary, and mesothelioma cancer[6]. As observed in North Carolina, USA, where 3,002 workers who were in contact with chrysotile were followed-up during a month, the incidence of lung cancer varied according to the fiber accumulation[29].

The impact of asbestos surpasses biological aspects, causing significant psycho-emotional disorders. In Spain, recent studies pointed out that psycho-emotional disorders, such as somatization, obsessive-compulsive disorders, depression, paranoia, phobic anxiety, were found in workers affected by asbestos[35]. Therefore, it is necessary to recognize that asbestos-related diseases are occupational diseases, entitled to paid compensation and which need early diagnosis[28].

It is important to note the potential risk of asbestos exposure outside the working environment[6]. In a study conducted with women married to workers directly exposed to asbestos showed incidence of mesothelioma and a significant increase in malignant respiratory neoplasms, thus confirming the impact on the family health due to the contact of asbestos fibers with workers' clothes and objects[34].

The studies concluded that there are no safe levels of exposure, even for a short period[10]. In Italy, workers who were followed up during a month in a leading company in the sector of asbestos manipulation between the years 1946 and 1984 fell ill with pleural diseases, confirming the development of diseases regardless of exposure length of time[26].

Retrospective and prospective studies warn that mortality due to diseases caused by asbestos exposure is reaching alarming figures, presenting a major public health problem worldwide.

FINAL CONSIDERATIONS

The impact of asbestos on adult health was characterized by the development of diseases with high mortality rates and prevalence of malignant mesothelioma; illnesses resulting from work exposure for the male workers, and their families, especially the women, wives of these workers, and related to environmental exposure; the long period of latency for developing asbestos-related diseases, with implications for the early diagnosis. Knowledge production and debate on the impact gain momentum in the field of workers' health and the population's overall health on the need for banning its use in countries that still produce it in industrial and commercial scale. Even with the confirmation of diseases caused by asbestos, countries like Brazil continue to produce and consume it without a legislation that could ban its use, due to economic issues.

The asbestos ban at global scale would be possible by replacing the fiber with other materials for manufacturing products, through the development of technological and economic mechanisms. Studies have emphatically shown that there is no safe way to work with products containing asbestos.

Currently, the WHO recommends actions to prevent diseases related to asbestos exposure, to optimize early diagnosis, to establish the registry of exposed persons, and follow-up for those who suffer from asbestos-related illnesses. The sickness due to malignant mesothelioma led to significant prevalence for this study. Mortality rate is alarming, taking into consideration that the therapeutic possibilities are limited.

It is worthy noting the importance of expanding the national scientific production on this topic. Brazil is the third largest world asbestos producer and there is a lack of retrospective and prospective studies on its impact on the health of the adult population, in order to define the monitoring and control of the exposed population.

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