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RISK FACTORS FOR LUNG CANCER

ABSTRACT

The authors present the analysis of the main risk factors for lung cancer, such as smoking, including passive one, industrial pollution of environment, air pollution, ionizing radiation and et al. It has been shown that lung cancer should be referred to a socially significant morbidity, prevention and treatment problems of which are not settled yet.

Keywords: lung cancer, risk factors, malignant tumors.

In most countries lung cancer is a wide spread form of tumor and one of the most important medical and social-economic problems. About 1.6 mln new cases of the given morbidity are registered annually (about 1 mln men), 55% is in the developing countries. The largest number of patients is registered in Asia (54.3%), Europe (24.2%) and Northern America (14.7%) [37].

Lung cancer is in the 1st place in the MT morbidity structure. A proportion of the given pathology in developed countries is 13.0% (the 2nd place after colorectal cancer), in developing countries -12.4% (the 1st place). Lung cancer morbidity of women (8.5%) is less than men's morbidity (16.5%). Maximum proportion of men LC in European countries is (16.8%) and Northern America-(15.1%), women in Northern America (14.3) ,in Asia (9.4) [2.

One of the reasons of MT spread is population "ageing". Morbidity increase owing to demographic component will be-23.2% in developing countries, in developed ones it's lower-12.2% [42].

In the Russian Federation in 2010 81.4% of patients were men. 65.8% of patients were 60 and older. In 2010 women LC was in the 10th place, its proportion-3.8(in 1998-4.5%) "Rough" data (RD) of men and women morbidity was 40.2 o/oooo in 2010 (in 1998-44.2o/oooo). Standardized data (SD) of men morbidity (54.0o/oooo) is lower by 19.3% than in 1998. Maximum men morbidity is in the age group of 70-74, women-75 and more. The ratio of men and women morbidity at the age of 65-69 is 9.9. Middle age of morbidity is 64.4-men, 67.7-women [19].

The highest level of morbidity is found out in Siberia and Far East, men (307.4 and 291.4 o/oooo, women (218.6 and 214.2 o/oooo accordingly. The highest data of men morbidity are in Altai (104.9), in Magadan (104.4), women population- in Magadan (19.3), Zabaikalsk (14.6), Republic Tyba (12.1). Lung cancer risk in RF during a man life (0-74) is very high in 2010, it made up 6.85% (in 1989-9.86%), women risk is lower-0.86%.

According to (BO3) Committee data 90% of tumors are the result of outer reasons and 10% depends on genetic factors {35}. The main reason of lung cancer is smoking. Research data found out that 85-95% of men morbidity and 65-80% of women one etiologically are connected with smoking [48.56].

The first epidemiological works associating smoking with LC were published in Germany at the end of 1930 and in the 50s this fact was supported by some independent researches. Ten years later some serious activities were begun against this dangerous habit in Europe and the USA [57]. Tobacco smoke consists of nicotine and about 4000 chemical combinations out of which 438 ones promote LC: polycyclic aromatic hydrocarbons (PAH), benzopyrene, aromatic aminas (naphthylamine, aminobiphenyl), nitro-compounds, nitrosamine, vinyl chloride, benzol, formaldehyde, phenols, chromium, cadmium, polonium-210 free radical etc. [5.

Risk of men smoked some years ago increased 9-17 times depending on a number of smoked cigarettes a day. 10 cigarettes a day is equal to 8 morbidities with cancer, 10-19 cigarettes a day-19, 20-29 cigarettes-20, 30 cigarettes-35 [6.3].

In many countries a number of smoking women increased sharply and reached men's level {39}. LC of smoking women is equal to 12.7; 25-30 cigarettes a day increase morbidity to 20-30 {31,62}. Low data of women are the result of late starting to smoke. Carcinogen effect is the result of 20-25 latent period.

LC risk depends on duration of smoking [11,40]. Giving up smoking lowers a level of LC. Cumulative risk of men given up smoking at the age of 50-59 is equal to 7, at the age of 40-49- 5, at the age of before 40 is equal to non-smokers [6].

Passive smoking influences non-smokers 1.7 times. Metaanalysis of epidemiological researches found out that risk of non-smoking women at home and work increases by 17-25%, men-36%, at work-28% A longer smoke risk increases to 30% depending on a doze [27,61].

Industrial pollution of environment influences MT morbidity. Most occupational kinds of cancer are the result of carcinogen factors. A latent period lasts many years. A number of industrial LC is 6.7-15.0% [56,58.60].

Carcinogen substances (group 1, MAIR classification) increasing LC risk are asbestos, benzpirenium, beryllium, chlormethyl-ether, mustard gas, cadmium and its derivatives, crystalline silicon, arsenic, nickel and its combinations, talk, 2,3,7,8-tetrachlordybenzoparadioxide, formaldehyde vapour are coal-resin, chemical industry (rubber, soot, tar, pitch, mineral oils, strong , inorganic acids containing sulphuric acid vapour.

To industries having LC risk can be referred: aliminium and foundry industry, gasification and coal-coke, coal resin, chemical industry (rubber production, isopropyl alcohol, painting. LC risk is high for workers dealing with asbestos production, textile industry, ship-yards and cement production [59]. LC statistics is high for the following occupations: mining and quarry workers, wood production for women [24.25,33,34,36,47]. In RF state epidsupervision registered 328 occupational kinds of cancer, out of it 159- LC [3].

One of the main factors influencing a man risk to fall ill with LC is air pollution. People living in highly developed industrial cities, especially heavy, chemical, oil-chemical, oil-refining industries, suffer from LC than cities of light and food industry [2]. Non-smokers living on territories of high air pollution run the risk to die from LC. It's by 20% higher than people living on "clean" territories [43].

Benzpirenium (BP) is taken as an air pollution indicator. Long influence of BP increases the frequency of LC, it makes up 1.5-1.75 NG/M, it exceeds (.....) 1.5-2 times. Carburettor and dizel engines throw out 20 MCG/M of BP. A city inhabitant can inhale about 0.6 MCG of BP of car waste. 50 cigarettes have the same number of BP.

Epidemiological research comes to the conclusion that after smoke risk LC connected with the air pollution makes up 1.4-1.5. It's noticed in cities of Siberia and Far East [14,15]. Death risk from MT in polluted regions is 2.5 times, among men-2 times higher than in the planned region [10]. Not only big energetic plants but also waste of small boiler-houses and stoves can be a LC risk factor.

Ionizing radiation is a proved factor of MT. LC risk is very high for the people experienced atom bombing, irradiated for diagnosing and treating aims etc. {22.30}. LC risk is connected with breast R-ray in Russia and other countries of Eastern and Central Europe. People who had 11-20 X-ray examinations their risk was 1.33; 21-30 examinations- 1.49; 31-40 examinations- 1.52. Maximum risk was 2.15 of people who had more than 40 X-ray examinations {26}

In the USA 28347 workers of two atom enterprises got average doze 10m3v. A statistic tie between a doze, radiation and death is .....=17). Workers of radiochemical and plutonium 6,6m3v in their lungs. But in some epidemiological researches a high LC risk in atom enterprises is not proved [1.6,12].

Radon is an inert, heavy, invisible gas without smell made up from radium as a result of uranium dissociation and it's a natural source of ionizing radiation. Radon concentration in the atmosphere changes depending on a location, time, altitude and meteo conditions. It causes active influence on man inner organs (bronchils and lung epithelial). Researches carried out in Sweden, the USA, China, Moscow found out LC

risk increase by 3-14% due to a high level of radon in dwelling houses {6,8}. Radon is the second main factor after smoking causing LC. Carried out meta-analysis proved that radon caused 10% of all deaths and 30% of deaths from LC of non-smokers. The main source of radon and its product decay are building materials [17,19]. Concentration of radium in a stone, concrete, brick, gyps is about 40 BQ/KG (1……..) [13]. Wood is ecologically pure, specific radio-activity is lower 1BQ/KG.

Risk factors of LC are alcohol, overweight and passive physical activity [46.48.49,53]. Chronic inflammatory changes of bronchial membrane cause LC of most patients.

Research results confirm that one of the reasons causing cancer morbidities is concentration of free radicals in the organism. It can be protected by antioxidants of ferment and non-ferment nature. Under the influence of radiation, pollution and other factors free radicals are worked out. Redundancy of it and lack of antioxidants in the organism hurt nuclein acids, proteins and other macromolecule cells. People eating a large amount of fruit or vegetables, especially tomatoes [28,32] and a group of cruciferates [45 lower LC risk (21,38,44}. A group of cruciferates contains glucocynalates which of II phase detoxification (GST) [51.

Flavonoids contain antioxidants and anti-inflammation characteristics. Strawberries, green and black tea (katechin), Brussels sprout, apples, beans and onions (querrcetin) contain flavonoide and protect organism from LC blockading angiogenesis and throwing out apoptosis. Flavonoids also work against tobacco toxin protecting DNA [54].

Analysis of vitamin A is contradictory [44,52]. But its rich in vitamins reacts to chemical carcinogens and inhibits cell differentiation. Beta-carotene and vitamin E (alfa-tocopherol) are strong antioxidants, their role is to stop a process of carcinogen [5.7]. Deficit of vitamins B12, B6, 7, folic acid, zinc and iron causes two-chained DNA break similar to ionizing radiation [23,41].

Level of air pollution is high enough in towns of the Republic Sakha (Yakutia) as the town air is full of benzopyrene and formaldehyde, its average annual level exceeds the norm 2-3 times. Maximum concentration is reached: weighed substances-formaldehyde-2-2.5 ….., hydrogen supplied- 1.3 …… Average month concentration of benzopyrene exceeds the norm more than 7 times. The main reasons of the air pollution are transport overload in the town streets, lack of modern gas cleaning and dust-catching settings in the industrial units, waste of plants and factories, a low quality of roads, not enough green plantations, unsatisfactory situation of housing and communal services [4].

Thus, lung cancer should be referred to a socially significant morbidity, problems of which are not settled yet. Most oncologists are of the opinion that modern prophylaxis, high consciousness, self-control, perfection of early clinical diagnosis will play a great role in lowering death from oncology.

REFERENCES

1. Belosohov M.V. Patomorfologicheskaja harakteristika raka legkogo u rabotnikov zavoda po proizvodstvu plutonija: avtoref. dis. kand. med. Nauk [Pathomorphological characteristic of lung cancer of plant workers producing plutonium; synopsis of MD thesis]. Chelyabinsk, 2006, p25.

2. Vorobev V.A. Jepidemiologicheskie aspekty raka legkogo v Tomskoj oblasti: dis. kand. med. nauk. [Epidemiological aspects of lung cancer in Tomsk region of MD thesis]. Tomsk, 2013, p209.

3. Gosudarstvennyj doklad. O sanitarno-jepidemiologicheskoj obstanovke v Rossijskoj Federacii v 2005 godu. [State report. Sanitary-epidemiological situation in the Russian Federation in 2005.]. Moscow, Federalnyj centr gigieny i jepidemiologii Rospotrebnadzora, 2006, p.289.

4. Doklad «Ob jekologicheskoj situacii v Respublike Saha (Jakutija) v 2011 godu» Ministerstvo ohrany prirody RS (Ja). [Report "Ecological situation in the RS (Y) in 2011"]. Ministry of nature and ecology in RS(Y)-2011-elect [Ministry of nature and ecology in RS(Y)]. Jakutsk, Jelektron dan. Rezhim dostupa: http://www.adm@adm.sakha.gov.ru, 2011.

5. Zaridze D.G. Kancerogenez [Carcinogenes]. Moscow, Medicina, 2004, p. 576.

6. Zaridze D.G. Profilaktika raka. Rukovodstvo dlja vrachej [Prophylaxis of cancer. Instruction for doctors]. Moscow, IMA-PRESS, 2009, p.224.

7. Zaridze D.G. Jepidemiologija i profilaktika raka [Epidemiology and prophylaxis of cancer]. Voprosy onkologii [Questions of oncology]. St. Petersburg, 2001, pp. 6-14.

8. Zemljanaja G.M. Zaridze D.G. Zagrjaznenie vozduha zhilyh pomeshhenij radonom i risk razvitija raka legkogo [Air pollution by radon in dwelling houses and development of lung cancer risk.]. Jeksper. onkol. [expert.oncol.]. Kiev, 1991, pp. 3-7.

9. Kirillova Je.V. Efimov G.E. Ruchkin V.N. Harakteristika projavlenij raka legkogo na territorijah, otlichnyh po tehnogennym nagruzkam na atmosfernyj vozduh [Characteristic of lung cancer in the territories of technogenic load]. Kreativnaja hirurgija i onkologija [Creative surgery and oclogy]. Ufa, 2013, pp. 10-16.

10. Komleva V.A. Jepidemiologicheskoe izuchenie onkologicheskoj zabolevaemosti v rajonah razmeshhenija TJeS i AJeS [Epidemiological research of oncological morbidity in the regions of HES and AES]. Gigiena i sanitarija [Hygiene and sanitation]. Moscow, 1999, pp. 10-13.

11. Mikhailov E.A. Levshin V.F. Goryacheva A.N. Tsybulina L.P. Anamnez issledovanie kuril'shhikov so zlokachestvennymi opuholjami [Anamnesis research of smokers with malignant tumours]. Vestnik RONC im. N. N. Blohina RAMN [Vestnik ROSC named after N.N.Blokhin RAMS]. Moscow, 2000, pp. 36-42.

12. Mukerija A.F. Zaridze D.G. Jepidemiologija i profilaktika raka legkogo [Epidemiology and lung cancer prophylaxis]. Vestnik RONC im. N. N. Blohina RAMN [Vestnik ROSC named after N.N.Blokhin RAMS]. Moscow, 2010, pp. 3-13.

13. Nazirov R.A. Peresypkin E.V. Tarasov I.V. Vereshhagin V.I. Snizhenie estestvennoj radioaktivnosti cementnyh betonov [Lowering of natural radio activity of cement concrete]. Novosibirsk, Izv. vuzov. Stroitelstvo, 2007, p. 45.

14. Odincova I.N. Gigienicheskie aspekty formirovanija zabolevaemosti rakom ljogkogo v regione Sibiri i Dal'nego Vostoka: avtoref. dis. kand. med. Nauk [Hygienic aspects of morbidity with lung cancer in Siberia and Far East: synopsis of MD thesis]. Kemerovo, 1999, p. 25.

15. Pisareva L.F. Bojarkina A.P. Tahauov P.M. Karpov A.B. Osobennosti onkologicheskoj zabolevaemosti naselenija Sibiri i Dalnego Vostoka [Peculiarities of oncological morbidity in Siberia and Far East]. Tomsk, Tomsk University, 2001, p. 411.

16. Sadovnikov A.A. Panchenko K.I. Rak legkogo na fone posttuberkuleznyh izmenenij [Lung cancer against post- tubercular changes]. Rossijskij onkologicheskij zhurnal [Russian oncological journal]. Moscow, 2011, pp. 29-33.

17. Sidelnikova O.PStefa-nenko. I.V. Sokolov P.Je. Radiacionnaja bezopasnost v zdanijah: spravochnik [Radiation safety in buildings: reference book]. Moscow, Jenergoatomizdat, 2006, p. 328.

18. Suslin V.P. Chelovek, radon, stroitel'nye materialy [Man, radon, building materials]. Proektirovanie i stroitel'stvo v Sibiri [Projecting and construction in Siberia]. Novosibirsk, 2002, p. 39-40.

19. Chissov V.I. Starinskogo V.V. Petrovoj G.V. Zlokachestvennye novoobrazovanija v Rossii v 2010 godu (zabolevaemost' i smertnost') [Malignant tumors in Russia in 2010 (Morbidity and mortality)]. Moscow, FGU «MNIIOI im. P.A. Gercena Rosmedtehnologij», 2012, p. 260.

20. Shabad L.M. O cirkuljacii kancerogenov v okruzhajushhej srede [About circulation of carcinogens in environment]. Moscow, Medicina, 1973, p.35.

21. Alberg A.J. Epidemiology of lung cancer: looking to the future / A.J. Alberg, M.V. Brock, J.M. Samet // J Clin. Oncol. - 2005. - Vol.23. - P. 3175 -3185.

22. Alberg A.J. Epidemiology of lung cancer: ACCP evidence-based clinical practice guidelines (2nd edition) / A.J. Alberg, J.G. Ford, J.M. Samet // Chest. -2007. - №132, Suppl. 3. - P. 29-55.

23. Ames B. Cancer prevention and diet: Help from single nucleotide polymorphisms / B. Ames // Proc. Natl. Acad. Sci. USA. - 1999. - Vol. 96. -P. 12216-12218.

24. Bardin-Mikolajczak A. Occupation and risk of lung cancer in Central and Eastern Europe: the IARC multi-center case-control study / A. Bardin-Mikolajczak, J. Lissowska, D. Zaridze, V. Janout, J. Fevotte et al. // Cancer Causes Control. - 2007. - Vol. 18.-P. 645-654.

25. Beveridge R. Lung cancer risk associated with occupational exposure to nickel, chromium VI, and cadmium in two population-based case-control studies in Montreal / R. Beveridge , J. Pintos , M.E. Parent, J. Asselin , J. Siemiatycki // Am. J. Ind. Med. - 2010. - Vol. 53(5). - P. 476-485.

26. Boffetta P. Involuntary smoking and lung cancer / P. Boffetta // Scan. J. Work Environ. Health. - 2002. - Vol. 28 (Suppl 2). - P. 30—40.

27. Boffetta P. Cancer of the lung, larynx and pleura. In: Textbook of cancer epidemiology 2nd edn. / P. Boffetta, D. Trichopoulos /Eds. H.O. Adami, D. Hunter, D. Trichopoulos. - Oxford: Oxford University Press, 2008. - 782 p.

28. Bond G.G. Dietary vitamin A and lung cancer: results of a case-control study among chemical workers / G.G. Bond, F.E. Thompson, R.R. Cook//Nutr. Cancer. - 1987.-№ 9.-P. 109-121.

29. Boyce J.D. Ionizing radiation / J.D. Boyce // Cancer Epidemiology and Prevention / Eds D. Schottenfeld, J. F. Fraumeni. - Oxford: University Press, 2006.-P. 259-293.

30. Boyle P. Cancer incidence and mortality in Europe / P. Boyle, J. Ferlay // Ann. Oncol.-2005.-Vol. 16.-P. 481-488.

31. Brennan P. High Cumulative Risk of Lung Cancer Death among Smokers and Nonsmokers in Central and Eastern Europe / P. Brennan, A. Crispo, D. Zaridze, N. Szeszenia-Dabrowska, P. Rudnai et al. // Am. J. Epidemiol. - 2006. - Vol. 164.-P. 1233-1241.

32. Brennan P. A multicenter case-control study of diet and lung cancer among non-smokers / P. Brennan, C. Fortes, J. Butler et al. // Cancer Causes Control. -2000.-№11.-P. 49-58.

33. Carel R. Occupational exposure to asbestos and man-made vitreous fibres and risk of lung cancer: a multicenter case-control study in Europe / R. Carel, A.C. Olsson, D. Zaridze, N. Szeszenia-Dabrowska, P. Rudnai, J. Lissowska, et al. // Occup. Environ. Med. - 2007. - Vol. 64. - P. 502-508.

34. Cassidy A. Occupational Exposure to Crystalline Silica and Risk of Lung Cancer. A Multicenter Case-Control in Europe / A. Cassidy, Mannetje, M. Martie van Tongeren, J.K. Field, D. Zaridze, N. Szeszenia-Dabrowska, T. Fletcher et al. // Epidemiology. -2007. - Vol. 18. - P. 36-43.

35. Dumitrescu R. Undestending breast cancer risk - where do we stand in 2005? / R. Dumitrescu, I. Cotarla // J. Cell. Mol. Med. - 2005. - № 9. - P. 208-221.

36. Durusoy R. Lung cancer risk and occupational exposure to meat and live animals / R. Durusoy, P. Boffetta, A. Mannetje, D. Zaridze, N. Szeszenia-Dabrowska et al. // Int. J. Cancer. - 2006. - Vol. 118. - P. 2543-2547.

37. Ferlay J. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008/ J. Ferlay, H.R. Bray, D. Forman, C. Mathers, M.D. Parkin // Int. J. Cancer. - 2010. -№ 127.-P. 2893-2917.

38. Feskanich D. Prospective study of fruit and vegetable consumption and risk of lung cancer among men and women / D. Feskanich, R.G. Ziegler, D.S. Michaud et al. // J Natl. Cancer Inst. - 2000. - Vol. 92. - P. 1812-1823.

39. Freedman N.D. Cigarette smoking and subsequent risk of lung cancer in men and women / N.D. Freedman, M.F. Leitzmann, A.R. Hollenbeck, A. Schatzkin, C. Abnet // Lancet Oncol. - 2008. - Vol. 9, № 7. - P. 649-656.

40. Gan Q. Disease burden of adult lung cancer and ischaemic heart disease from passive tobacco smoking in China / Q. Gan, K. Smith, S. Hammond, Hu. Teh-wei // Tobacco Control. - 2007. -Vol. 16. - P. 417-422.

41. Gavey D.S. Genetic epidemiology and public health: hope, hype and future prospects / D.S. Gavey, S. Ebrahim, S. Lewis et al. // Lancet. - 2005. - Vol. 366. -P.1484-1498.

42. GLOBOCAN 2008, International Agency for Research on Cancer [Электронный ресурс]. - Режим доступа: http://globocan.iarc.fr/

43. Grens K. Air pollution tied to lung cancer in non-smokers / K. Grens // American Journal of Respiratory and Critical Care Medicine. - 2011. - №4. -P. 19.

44. Holick C.N. Dietary carotenoids, serum betacarotene, and retinol and risk of lung cancer in the alpha-tocopherol, beta-carotene cohort study / C.N. Holick, D.S. Michaud, R. Stolzenberg-Solomon et al. //Am. J. Epidemiol. - 2002. - Vol. 156.-P. 536-547.

45. Hu J. Risk factors for lung cancer among Canadian women who have never smoked / J. Hu, Y. Mao, D. Dryer et al. // Cancer Detect Prev. - 2002. - № 26. -P. 129-138.

46. Hursting S.D. Calorie restriction, Aging, and Cancer prevention: Mechanisms of Action and Applicability to Hu-mans / S.D. Hursting, J.A. Lavigne, D. Berrigan, S.N. Perkins, J.C. Barrett // Annu. Rev. Med. - 2003. - Vol. 54. - P. 131-152.

47. Kleinerman R.A. Lung cancer and indoor exposure to coal and biomass in rural China / R.A. Kleinerman, Z. Wang, L. Wang, C. Metayer, S. Zhang, A.V. Brenner, S. Zhang, Y. Xia et al. // J. Occup. Environ. Med. - 2002. - Vol. 44, № 4. - P. 338-344.

48. Knekt P. Leanness and lung cancer risk / P. Knekt, M. Heliovaara, A. Rissanen et al. // Int. J Cancer. - 1991. - Vol. 49. - P. 208-213.

49. Korte J.E. Dose-specific meta-analysis and sensitivity analysis of the relation between alcohol consumption and lung cancer risk / J.E. Korte, P. Brennan, S.J. Henley et al.// Am J Epidemiol. -2002. -Vol. 155. -P. 496-506.

50. Krewski D. Residential radon and risk of lung cancer: a combined analysis of 7 North American case-control studies / D. Krewski, J.H. Lubin, J.M. Zielinski et al. // Epidemiology. - 2005. - №16 (2). - P. 137-145.

51. London S.J. Isothiocyanates, glutathione S-transferase MI and TI polymorphisms, and lung-cancer risk: a prospec-tive study of men in Shanghai, China / S.J. London, J.M. Yuan, F.L. Chung et al. // Lancet. - 2000. - Vol. 356. - P. 724-729.

52. Mannisto S. Dietary carotenoids and risk of lung cancer in a pooled analysis of seven cohort studies / S. Mannisto, S.A. Smith-Warner, D. Spiegelman, et al. // Cancer Epidemiol. Biomarkers Prev. - 2004. - №13. - P. 40-48.

53. Mao Y. Physical activity and the risk of lung cancer in Canada / Y. Mao, S. Pan, S.W. Wen et al. // Am. J Epi-demiol. - 2003. - Vol. 158. - P. 564-575.

54. Marchand L. Le. Intake of flavonoids and lung cancer / L. Le Marchand, S.P. Murphy, J.H. Hankin et al. // J Natl. Cancer Inst. - 2000. - Vol. 92. - P. 154-160.

55. Parkin Ed. by D. Cancer incidence in Five Continents, Vol. IX. / Ed. by D. Parkin, S. Whelan, J. Ferlay., L. Teppo, D. Thomas. - IARC. Sci publ. №160. - Lyon, 2009. - 897 p.

56. Parkin D.M. The fraction of cancer attributable to lifestyle and environmental factors in the UK in 2010 / D.M. Parkin, L. Boyd, L.C. Walker // British Journal of Cancer. - 2011. - №105 (S2). - P.77-81.

57. Proctor R.N. Tobacco and the global lung cancer epidemic / R.N. Proctor // Nat. Rev. Cancer. - 2001. - Vol. 1. - P. 241-255.

58. Rushton L. The burden of occupational cancer in Great Britain / L. Rushton, S. Hutchings, T. Brown - Published by the Health and Safety Executive 10. - 2007. - 119 p.

59. Siemiaticki J. Occupation / J. Siemiaticki, L. Richardson, P. Boffetta // Cancer Epidemiology and Prevention / Eds. D. Schottenfeld, J.F. Fraumeni. -Oxford: University Press, 2006. — P. 222-354.

60. Steenland K. Dying for work: the magnitude of US mortality from selected causes of death associated with occu-pation / K. Steenland et al. // American Journal of Occupational Medicine. – 2003.-Vol. 43. - P. 461—482.

61. Taylor R. Passive smoking and lung cancer: a cumulative metaanalysis / R. Taylor, R. Cumming, A. Woodward et al. // Aust. NZ J Public Health. - 2001. - Vol. 25.-P. 203-211.

62. Thun M.J. Tobacco / M.J. Thun, S.J. Henley // Cancer Epidemiology and Prevention / Eds. D. Schottenfeld, J.F. Fraumeni. - Oxford University Press, 2006.-P. 217-242.

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