ATS/ERS Task Force: The Occupational Burden of Respiratory Disease

Literature search for IPF and other interstitial pneumonias

**IPF**

|  |  |
| --- | --- |
| Reference | Findings |
| *Case reports, case series* |  |
|  |  |
| *Case-control studies* |  |
| Scott 1990 | Occupational exposures to metal dust (OR 10.97, 95%CI 2.3-52.4), wood dust (OR 2.94, 95%CI 0.87-9.9), and stone/sand (OR 1.59,  95%CI 0.52-4.79) are associated with IPF |
| Iwai 1994 | The IPF rate more than doubled (p <0.01) among subjects engaged in occupations that exposed them to dust or organic solvents |
| Iwai 1994 | Higher odds ratio was noted among metal production workers and miners compared with healthy and hospital control subjects (1.37 and 1.34, respectively, p< 0.01) |
| Hubbard 1996 | Occupational exposures to metal dust (OR 1.68, 95% CI 1.07-2.65, p = 0.024), wood dust (OR 1.71, 95% CI 1.01-2.92, p = 0.048), and are associated with CFA |
| Mullen 1998 | Occupational exposure to any dust (OR 2.37, 95% CI 0.67-8.44), asbestos (OR 6.77, 95% CI 0.57-90.7), and silica (OR 11, 95% CI 1.05-115) was associated with ILD |
| Hubbard 2000 | Direct relation between duration of exposure and the risk of CFA (OR per 10 years of exposure 1·71, 95%CI 1.09-2.68, p=0.02) |
| Baumgartner 2000 | Occupational exposure to metal dust (OR = 2.0, 95% CI: 1.0, 4.0), stone cutting/polishing (OR = 3.9, 95% CI: 1.2, 12.7), stone cutting/polishing (OR = 3.9, 95% CI: 1.2, 12.7), and vegetable dust/animal dust (OR =4.7, 95% CI: 2.1, 10.4) are associated with IPF |
| Miyake 2005 | Occupational exposure to metal dust (OR 9.55, 95%CI 1.68-181.12) is an independent risk factor for IPF |
| Gustafson 2007 | Occupational exposure to birch dust (OR 2.7, 95% CI 1.3-5.65) and hardwood dust (OR 2.7, 95% CI 1.14-6.52) are associated with IPF |
| Pinheiro 2008 | Mortality odds ratios were raised for people working in “Wood buildings and mobile homes” (MOR 5.3, 95% CI 1.2-23.8), “Metal mining” (MOR 2.2, 95% CI 1.1-4.4), and “Fabricated metal products” (MOR 1.7, 95% CI 1.0-3.1) |
| Garcia-Sancho 2011 | Occupational exposure to dusts, smokes, gases orchemicals was associated with IPF (OR 2.4, 95% CI, 1.4-4.0, p = 0.001) |
| Awadalla 2012 | Occupational exposure to wood dust for men (OR 2.71 (1.01-7.37, 95% CI)) and animal feeds, products, and dust (OR 1.78 (1.01-3.13) 95% CI) and insecticides/pesticides (1.04-72.17, 95% CI) for women. |
| Ekstrom 2014 | Smoking has dose related association with increased risk of severe IPF, occupational exposures increase risk |
| *Cohort/Population-based studies* |  |

**PAP**

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| --- | --- |
| Reference | Findings |
| *Case reports, case series* |  |
| Chapman 1932 | 3 cases (2 fatal) of acute silicosis in abrasive soapmakers |
| Cabot 1934 | Fatal case of acute silicosis in abrasive soapmaker; histology showed alveolar filling with pink-staining fluid with high protein content;  Existence of 6 other cases (5 fatal) from same plant noted |
| Rosen 1958 | First use of term “PAP;” 27 cases including 4 lumberyard workers, 1 carpenter, 2 electrical workers (1 in factory producing cannon shells with smoke exposure), 1 butcher/fruit sprayer (lead and sulfur exposures), 1 animal quarters attendant exposed to rat-cage cleaner, 1 printing plant worker, 1 machinist, 1 toothpaste factory worker (silica flour) |
| Ray 1962 | Fatal case of PAP in tin miner with tin in lung tissue |
| Buechner 1969 | 4 fatal cases of PAP in sandblasters with average 4 years’ tenure |
| Davidson 1969 | Review of 139 published cases; about half exposed to dust/fumes (agricultural, bakery flour, wood dust, varnish, paint, petrol, cleaning fluids); 10 cases exposed to silica |
| Suratt 1977 | 4 cases (3 fatal) of silicosis in tombstone sandblasters with average 35 months’ tenure; 2 cases showed PAP |
| Xipell 1977 | Fatal case of PAP in quartz miller with 7 years’ tenure |
| Rubin 1980 | 13 cases of PAP seen at Toronto General Hospital 1974-8; 2 cases (1 fatal) with silica exposure (uranium miner and farmer who did sandblasting) |
| Kariman 1984 | 23 cases seen at Duke over 15 years; none had history of “unusual occupational exposure” |
| Miller 1984 | Case of PAP in aluminum rail grinder with aluminum in lung tissue |
| Owens 1988 | Fatal case of silicoproteinosis in sandblaster with <6 years’ tenure |
| McCunney 1989 | Case of PAP in cement truck driver with exposure to Portland cement (20% silica) |
| Dawkins 1991 | Case of PAP in explosives worker with exposure to NO2 |
| Keller 1995 | Case of PAP in spray painter with titanium exposure and titanium in lung tissue |
| Goldstein 1998 | 24 cases of PAP seen at Cleveland Clinic; 12 were laborers without silica exposure |
| Ben-Dov 1999 | 19 cases of PAP seen in Israel; exposure history not reported, with exception of 1 case described as aluminum worker whose disease onset preceded initial exposure but who apparently relapsed after exposure |
| Esteban Palacio 2000 | Case of PAP in worker who was grinding cement for 3 weeks; birefringent particles on BAL |
| McDonald 2000 | Case of PAP in woman exposed to cellulose-containing insulation dust through ventilation system of her home (domestic case) |
| Briens 2002 [FRENCH] | 41 cases of PAP, 39% with occupational exposure to inhaled dusts |
| Hosokawa 2004 | Case of PAP and silicosis in former coal miner with positive anti-GM-CSF autoantibodies; 50 cases of silicosis without PAP had negative anti-GM-CSF autoantibodies |
| Marchiori 2007 | 13 cases of silicoproteinosis in sandblasters with tenure 11 months to 8 years |
| Inoue 2008 | Japanese national registry of PAP cases; 26% of 223 autoimmune PAP cases reported inhalational dust exposure (32% of men and 13% of women) |
| Cummings 2010 | 2 cases (1 fatal) of PAP in indium processing workers |
| Xiao 2010 | 1 case of PAP in sandblaster in mobile phone production facility with indium exposure |
| Bonella 2011 | 70 cases of PAP seen at single institution in Germany; 36 (51%) reported occupational dust/fume exposure (silica, aluminum, sawdust, etc). |
| Cummings 2012 | 10 cases (2 fatal) of ILD with PAP diagnosis (3) or histologic features (7) in indium processing workers; includes 2 cases reported in Cummings 2010 and 1 case reported in Xiao 2010 |
| *Case-control studies* |  |
| McEuen 1978 | 37 PAP cases, 13 controls; birefringent particle counts significantly higher in cases than controls; known/possible occupational exposure ascertained in 13 cases |
| Abraham 1986 | 24 PAP cases, 5 controls; increased number of birefringent particles in 78% of cases; increased inorganic particle concentration by SEM in all cases |
| Xiao 2015 | 45 PAP cases, 97 controls; 13 of 38 of patients with autoimmune PAP had a history of occupational inhalational exposure, which was not significantly higher than that of hospital controls (34.2% vs 19.6%,  p=0.072). All 4 cases (3 fatal, 1 transplanted) of non-autoimmune PAP had occupational exposures. |

**COP**

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| Reference | Findings |
| *Case reports, case series* |  |
| Sanz 1993 | Report of 22 cases (6 fatal, 1 transplant) of BOOP in textile air-brushing workers |
| Ould Kadi 1994 | 5 cases (1 fatal) of interstitial disease with a COP-like response in Algeria due to Acramin FWN. |
| Sole 1996 | 1-year follow-up of 27 cases of heavily exposed Spanish textile workers |
| Romero 1998 | Clinical description of 14 cases of OP in textile air-brushing workers |
| Alleman 2002 | Case of BOOP in a spice processing worker |
| Di Stefano 2003 | Case of BOOP in floor cleaner with benzalkonium compounds exposure |
| Sheu 2008 | Fatal case of BOOP in chemical factory worker with massive exposure to acetic acid from explosion |
| Doujaili 2010 | Case of organizing pneumonia related to hydrogen sulfide |
| Sanchez-Ortiz 2011 | COP developing following exposure to  ortho-phenylenediamine was described in a 29-year old lab worker |
| Ribeiro 2011 | organising pneumonia temporally associated with gold dust inhalation was reported in a 47 year old restorer of religious art |
| Cheng 2012 | Case of BOOP related to titanium nanoparticles in paint |
|  |  |
| *Case-control studies* |  |
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| *Cohort/Population-based studies* |  |
| Moya 1994 | Investigation of OP in 8 Spanish textile printing factories with 257 workers; 71 (28%) had respiratory abnormalities; 22 (9%) met a radiographic definition of OP. Cases linked to substitution of Acramin FWN (liquid) for Acramin FWR (powder). |

**OB**

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| Reference | Findings |
| *Case reports, case series* |  |
| Lowry 1956 | Case/s related to oxides of nitrogen |
| Becklake 1957 | Case/s related to oxides of nitrogen |
| Darke 1958 | Case/s related to oxides of nitrogen |
| Moskowitz 1964 | Case/s related to oxides of nitrogen |
| Jones 1973 | Case/s related to oxides of nitrogen |
| Horvath 1978 | Case/s related to oxides of nitrogen |
| Fleetham 1978 | Case/s related to oxides of nitrogen |
| Milne 1969 | Case/s related to oxides of nitrogen |
| Tse 1970 | Case/s related to oxides of nitrogen |
| Ramirez 1971 | Case/s related to oxides of nitrogen |
| Woodford 1979 | Case related to sulfur dioxide |
| Kraut 1988 | Case related to bromine compounds |
| Zwemer 1992 | Case/s related to oxides of nitrogen |
| Konichezky 1993 | Case related to thionyl chloride |
| McConnell 1986 | Cases in flavoring production facility |
| Akpinar-Elci 2004 | 9 cases of lung disease in microwave popcorn workers |
| Calvalcanti 2012 | Cases related to butter flavorings in cookie factory |
| CDC 2013 | Cases related to coffee production |
| Cullinan 2013 | Cases related to fiberglass-reinforced plastics production |
| Chen 2013 | Cases related to fiberglass-reinforced plastics production |
| Thomason 2003 | Case related to chemical weapons |
| Dompeling 2004 | Case related to sulfur mustard |
| *Case-control studies* |  |
|  |  |
| *Cohort/Population-based studies* |  |
| Kreiss 2002 | Increased respiratory symptoms and spirometric abnormalities in 117 current microwave popcorn workers |
| Kanwal 2006 | Diacetyl-associated respiratory morbidity in 6 microwave popcorn plants |
| van Rooy 2007 | 3 cases among 175 diacetyl production workers |
| van Rooy 2009 | Excess respiratory symptoms among diacetyl production workers compared to general population and lower-exposed co-workers |

**Lipoid Pneumonia**

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| *Case reports, case series* |  |
| Proudfit 1950 | Case report related to spraying naphtha solvent |
| Foe 1954 | Case report related to oil spray |
| Oldenburger 1972 | Case report related to burning fat fume |
| Cullen 1981 | Case report related to oil mist from steel rolling tandem mill |
| Pujol 1990 | Case report related to new car paraffin coating |
| Abad Fernandez 2003 | Case report related to paint exposure |

**RB**

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| *Case reports, case series* |  |
| Fraig 2002 | Includes case of RB in non-smoking mechanic with diesel fume and fiberglass dust exposure |
| Woo 2007 | Case of RB in non-smoking waitress with occupational secondhand smoke exposure |

**DIP**

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| *Case reports, case series* |  |
| Herbert 1982 | Case report in aluminum welder |
| Freed 1991 | Case report associated with chrysotile asbestos |
| Chelvanathan 2011 | Case report in aluminum welder |
| *Case-control studies* |  |
| Abraham 1981 | Tissue levels of inorganic particles higher in 62 cases than controls |

**Flock-workers’ lung disease**

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| *Case reports, case series* |  |
| Boag 1999 | 15 cases, describes novel histopathology (lymphocytic bronchiolitis) |
| Eschenbacher 1999 | 15 cases, describes clinical presentation and histopathology |
| Kern 2000 | 5 cases included 3 novel histopath, 1 DIP, 1 fibrosis |
| Barroso 2002 | Case report related to polyethylene flock |
| *Case-control studies* |  |
| Atis 2005 | 50 polypropylene flock workers vs. 45 controls; flock workers had higher risk of symptoms and functional and radiographic abnormalities |
| *Cohort/Population-based studies* |  |
| Lougheed 1995 | 6 cases identified from 88 workers at textile plant |
| Kern 1998 | 8 cases identified from 165 workers at nylon flock plant |
| Antao 2007 | Respiratory morbidity in rayon flock workforce |

**NSIP**

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| --- | --- |
| *Case reports, case series* |  |
| Ando 2006 | Case report in curry sauce factory worker |

**Others: LCH, Diffuse Pulmonary Hemorrhage, IIP, Giant Cell Interstitial Pneumonia (Hard Metal Disease)**

**REFERENCES**

**Organizing Pneumonia and other Uncommon Interstitial Disorders**

Abad Fern´andez, A., de Miguel D´ıez, J., L´opez Vime, R., G´omez Santos, D., N´ ajera

Botello, L., and Jara Chinarro, B. (2003). [lipoid pneumonia related to workplace

exposure to paint]. Arch Bronconeumol, 39(3):133–135.

Abraham, J. L. and Hertzberg, M. A. (1981). Inorganic particulates associated with

desquamative interstitial pneumonia. Chest, 80(1 Suppl):67–70.

Alleman, T. and Darcey, D. J. (2002). Case report: bronchiolitis obliterans organizing

pneumonia in a spice process technician. J Occup Environ Med, 44(3):215–216.

Ando, S., Arai, T., Inoue, Y., Kitaichi, M., and Sakatani, M. (2006). Nsip in a curry

sauce factory worker. Thorax, 61(11):1012–1013.

Antao, V. C. S., Piacitelli, C. A., Miller, W. E., Pinheiro, G. A., and Kreiss, K. (2007).

Rayon flock: a new cause of respiratory morbidity in a card processing plant. Am

J Ind Med, 50(4):274–284.

Atis, S., Tutluoglu, B., Levent, E., Ozturk, C., Tunaci, A., Sahin, K., Saral, A., Oktay,

I., Kanik, A., and Nemery, B. (2005). The respiratory effects of occupational

polypropylene flock exposure. Eur Respir J, 25(1):110–117.

Awadalla, N. J., Hegazy, A., Elmetwally, R. A., and Wahby, I. (2012). Occupational

and environmental risk factors for idiopathic pulmonary fibrosis in egypt: a

multicenter case-control study. Int J Occup Environ Med, 3(3):107–116.

Barroso, E., Iba˜nez, M. D., Aranda, F. I., and Romero, S. (2002). Polyethylene

flock-associated interstitial lung disease in a spanish female. Eur Respir J,

20(6):1610–1612.

Baumgartner, K. B., Samet, J. M., Coultas, D. B., Stidley, C. A., Hunt, W. C., Colby,

T. V., and Waldron, J. A. (2000). Occupational and environmental risk factors

for idiopathic pulmonary fibrosis: a multicenter case-control study. collaborating

centers. Am J Epidemiol, 152(4):307–315.

Blanc, P. D. (2007). Is giant cell interstitial pneumonitis synonymous with hard metal

lung disease? Am J Respir Crit Care Med, 176(8):834; author reply 834–834;

author reply 835.

Bradley, B., Branley, H. M., Egan, J. J., Greaves, M. S., Hansell, D. M., Harrison,

N. K., Hirani, N., Hubbard, R., Lake, F., Millar, A. B., Wallace, W. A. H., Wells,

A. U., Whyte, M. K., Wilsher, M. L., British Thoracic Society Interstitial Lung

Disease Guideline Group, B. T. S. S. o. C. C., of Australia, T. S., Society, N. Z. T.,

and Society, I. T. (2008). Interstitial lung disease guideline: the british thoracic

society in collaboration with the thoracic society of australia and new zealand and

the irish thoracic society. Thorax, 63 Suppl 5:v1–58.

Burkhart, J., Piacitelli, C., Schwegler-Berry, D., and Jones, W. (1999).

Environmental study of nylon flocking process. J Toxicol Environ Health A,

57(1):1–23.

Canessa, P. A., Prattic, L., Bancalari, L., Fedeli, F., Bacigalupo, B., and Silvano, S.

(2004). Respiratory bronchiolitis associated with interstitial lung disease. Monaldi

Arch Chest Dis, 61(3):174–176.

Carby, M. and Smith, S. R. (2000). A hazard of paint spraying. Lancet,

355(9207):896.

Chelvanathan, A., Drost, N., and Cutz, J.-C. (2011). Desquamative interstitial

pneumonia in an aluminum welder: a case report. CHEST Journal,

140(4 MeetingAbstracts):129A–129A.

Cheng, T.-H., Ko, F.-C., Chang, J.-L., and Wu, K.-A. (2012). Bronchiolitis obliterans

organizing pneumonia due to titanium nanoparticles in paint. Ann Thorac Surg,

93(2):666–669

Chonan, T. and Taguchi, O. (2004). The incidence of interstitial pneumonia patients

in an ito sputtering targets producing factory. Nihon Kokyuki Gakkai Zasshi,

42:185.

Churg, A., Myers, J., Suarez, T., Gaxiola, M., Estrada, A., Mejia, M., and Selman, M.

(2004). Airway-centered interstitial fibrosis: a distinct form of aggressive diffuse

lung disease. Am J Surg Pathol, 28(1):62–68.

Cordier, J. F. (2000). Organising pneumonia. Thorax, 55(4):318–328.

Craig, P. J., Wells, A. U., Doffman, S., Rassl, D., Colby, T. V., Hansell, D. M., Bois,

R. M. D., and Nicholson, A. G. (2004). Desquamative interstitial pneumonia,

respiratory bronchiolitis and their relationship to smoking. Histopathology,

45(3):275–282.

Cullen, M. R., Balmes, J. R., Robins, J. M., and Smith, G. J. (1981). Lipoid

pneumonia caused by oil mist exposure from a steel rolling tandem mill. Am

J Ind Med, 2(1):51–58.

Cummings, K. J., Donat, W. E., Ettensohn, D. B., Roggli, V. L., Ingram, P., and

Kreiss, K. (2010). Pulmonary alveolar proteinosis in workers at an indium

processing facility. Am J Respir Crit Care Med, 181(5):458–464.

Cummings, K. J., Nakano, M., Omae, K., Takeuchi, K., Chonan, T., long Xiao, Y.,

Harley, R. A., Roggli, V. L., Hebisawa, A., Tallaksen, R. J., Trapnell, B. C., Day,

G. A., Saito, R., Stanton, M. L., Suarthana, E., and Kreiss, K. (2012). Indium lung

disease. Chest, 141(6):1512–1521.

Cummings, K. J., Suarthana, E., Edwards, N., Liang, X., Stanton, M. L., Day,

G. A., Saito, R., and Kreiss, K. (2013). Serial evaluations at an indium-tin oxide

production facility. Am J Ind Med, 56(3):300–307.

Doujaiji, B. and Al-Tawfiq, J. A. (2010). Hydrogen sulfide exposure in an adult male.

Ann Saudi Med, 30(1):76–80.

Ekstrm, M., Gustafson, T., Boman, K., Nilsson, K., Tornling, G., Murgia, N., and

Torn, K. (2014). Effects of smoking, gender and occupational exposure on the

risk of severe pulmonary fibrosis: a population-based case-control study. BMJ

Open, 4(1):e004018.

FOE, R. B. and BIGHAM, R. S. (1954). Lipid pneumonia following occupational

exposure to oil spray. J Am Med Assoc, 155(1):33–34.

Fraig, M., Shreesha, U., Savici, D., and Katzenstein, A.-L. A. (2002). Respiratory

bronchiolitis: a clinicopathologic study in current smokers, ex-smokers, and

never-smokers. Am J Surg Pathol, 26(5):647–653

Freed, J. A., Miller, A., Gordon, R. E., Fischbein, A., Kleinerman, J., and Langer,

A. M. (1991). Desquamative interstitial pneumonia associated with chrysotile

asbestos fibres. Br J Ind Med, 48(5):332–337.

Garc´ıa-Sancho Figueroa, M. C., Carrillo, G., P´erez-Padilla, R., Fern´andez-Plata,

M. R., Buend´ıa-Rold´an, I., Vargas, M. H., and Selman, M. (2010). Risk factors

for idiopathic pulmonary fibrosis in a mexican population. a case-control study.

Respiratory medicine, 104(2):305–309.

Godbert, B., Wissler, M.-P., and Vignaud, J.-M. (2013). Desquamative interstitial

pneumonia: an analytic review with an emphasis on aetiology. Eur Respir Rev,

22(128):117–123.

Gustafson, T., Dahlman-H¨oglund, A., Nilsson, K., Str ¨om, K., Tornling, G., and Tor´en,

K. (2007). Occupational exposure and severe pulmonary fibrosis. Respiratory

medicine, 101(10):2207–2212.

Herbert, A., Sterling, G., Abraham, J., and Corrin, B. (1982). Desquamative

interstitial pneumonia in an aluminum welder. Hum Pathol, 13(8):694–699.

Heuck, F. and Hoschek, R. (1968). Cer-pneumoconiosis. Am J Roentgenol Radium

Ther Nucl Med, 104(4):777–783.

Hirai, K., Yamazaki, Y., Okada, K., Furuta, S., and Kubo, K. (2000). Acute

eosinophilic pneumonia associated with smoke from fireworks. Intern Med,

39(5):401–403.

Hoet, P. H., Gilissen, L. P., Leyva, M., and Nemery, B. (1999). In vitro cytotoxicity

of textile paint components linked to the ”ardystil syndrome”. Toxicol Sci,

52(2):209–216.

Homma, S., Miyamoto, A., Sakamoto, S., Kishi, K., Motoi, N., and Yoshimura, K.

(2005). Pulmonary fibrosis in an individual occupationally exposed to inhaled

indium-tin oxide. Eur Respir J, 25(1):200–204.

Homma, T., Ueno, T., Sekizawa, K., Tanaka, A., and Hirata, M. (2003). Interstitial

pneumonia developed in a worker dealing with particles containing indium-tin

oxide. J Occup Health, 45(3):137–139.

Hubbard, R., Cooper, M., Antoniak, M., Venn, A., Khan, S., Johnston, I., Lewis, S.,

and Britton, J. (2000). Risk of cryptogenic fibrosing alveolitis in metal workers.

Lancet, 355(9202):466–467.

Hubbard, R., Lewis, S., Richards, K., Britton, J., and Johnston, I. (1996).

Occupational exposure to metal or wood dust and aetiology of cryptogenic

fibrosing alveolitis. The Lancet, 347(8997):284–289.

Husain, M. H., Dick, J. A., and Kaplan, Y. S. (1980). Rare earth pneumoconiosis. J

Soc Occup Med, 30(1):15–19

Iwai, K., Mori, T., Yamada, N., Yamaguchi, M., and Hosoda, Y. (1994). Idiopathic

pulmonary fibrosis. epidemiologic approaches to occupational exposure. *Am J*

*Respir Crit Care Med*, 150(3):670–675.

Kern, D. G., Crausman, R. S., Durand, K. T., Nayer, A., and Kuhn, C. (1998). Flock

worker’s lung: chronic interstitial lung disease in the nylon flocking industry. *Ann*

*Intern Med*, 129(4):261–272.

Kern, D. G., Kuhn, C., Ely, E. W., Pransky, G. S., Mello, C. J., Fraire, A. E., and

Mller, J. (2000). Flock worker’s lung: broadening the spectrum of clinicopathology,

narrowing the spectrum of suspected etiologies. *Chest*, 117(1):251–259.

Kern, R. M., Singer, J. P., Koth, L., Mooney, J., Golden, J., Hays, S., Greenland, J.,

Wolters, P., Ghio, E., Jones, K. D., Leard, L., Kukreja, J., and Blanc, P. D. (2015).

Lung transplantation for hypersensitivity pneumonitis. *Chest*, 147(6):1558–1565.

Kim, Y. J., Jung, C. Y., Shin, H. W., and Lee, B. K. (2009). Biomass smoke induced

bronchial anthracofibrosis: presenting features and clinical course. *Respir Med*,

103(5):757–765.

Le Magrex, L. (1979). Raguenaud a.-pneumoconiose et cerium. *Archives des*

*Maladies Professionnelles*, 40:1–2.

Lewis, A., Gibbs, A., and Hope-Gill, B. (2012). Probable occupational pneumonitis

caused by inhalation of crushed clozapine. *Occup Med (Lond)*, 62(5):385–387.

Lison, D. and Delos, M. (2010). Pulmonary alveolar proteinosis in workers at an

indium processing facility. *Am J Respir Crit Care Med*, 182(4):578; author reply

578–578; author reply 579.

Lison, D., Laloy, J., Corazzari, I., Muller, J., Rabolli, V., Panin, N., Huaux, F.,

Fenoglio, I., and Fubini, B. (2009). Sintered indium-tin-oxide (ito) particles: a

new pneumotoxic entity. *Toxicol Sci*, 108(2):472–481.

long Xiao, Y., rong Cai, H., hua Wang, Y., qing Meng, F., and ping Zhang, D.

(2010). Pulmonary alveolar proteinosis in an indium-processing worker. *Chin*

*Med J (Engl)*, 123(10):1347–1350.

Lougheed, M. D., Roos, J. O., Waddell, W. R., and Munt, P. W. (1995).

Desquamative interstitial pneumonitis and diffuse alveolar damage in textile

workers. potential role of mycotoxins. *Chest*, 108(5):1196–1200.

Martinez, J. A. B. and Ramos, S. G. (2008). Inhalation of hydrocarbon combustion

products as a cause of dendriform pulmonary ossification. *Med Hypotheses*,

71(6):981–982.

McDonald, J. W., Ghio, A. J., Sheehan, C. E., Bernhardt, P. F., and Roggli, V. L.

(1995). Rare earth (cerium oxide) pneumoconiosis: analytical scanning electron

microscopy and literature review. *Mod Pathol*, 8(8):859–865

Miyake, Y., Sasaki, S., Yokoyama, T., Chida, K., Azuma, A., Suda, T., Kudoh, S.,

Sakamoto, N., Okamoto, K., Kobashi, G., Washio, M., Inaba, Y., and Tanaka, H.

(2005). Occupational and environmental factors and idiopathic pulmonary fibrosis

in japan. *Ann Occup Hyg*, 49(3):259–265.

Mons´ o, E., Tura, J., Pujadas, J., Morell, F., Ruiz, J., and Morera, J. (1991). Lung

dust content in idiopathic pulmonary fibrosis: a study with scanning electron

microscopy and energy dispersive x ray analysis. *British journal of industrial*

*medicine*, 48(5):327–331.

Moon, J., du Bois, R. M., Colby, T. V., Hansell, D. M., and Nicholson, A. G.

(1999). Clinical significance of respiratory bronchiolitis on open lung biopsy

and its relationship to smoking related interstitial lung disease. *Thorax*,

54(11):1009–1014.

Morell, F., Villar, A., ngeles Montero, M., Muoz, X., Colby, T. V., Pipvath, S., Cruz,

M.-J., and Raghu, G. (2013). Chronic hypersensitivity pneumonitis in patients

diagnosed with idiopathic pulmonary fibrosis: a prospective case-cohort study.

*Lancet Respir Med*, 1(9):685–694.

Moya, C., Ant, J. M., and Taylor, A. J. (1994). Outbreak of organising pneumonia

in textile printing sprayers. collaborative group for the study of toxicity in textile

aerographic factories. *Lancet*, 344(8921):498–502.

Mullen, J., Hodgson, M. J., DeGraff, C. A., and Godar, T. (1998). Case-control study

of idiopathic pulmonary fibrosis and environmental exposures. *J Occup Environ*

*Med*, 40(4):363–367.

Naccache, J.-M., Monnet, I., Nunes, H., Billon-Galland, M.-A., Pairon, J.-C., Guillon,

F., and Valeyre, D. (2008). Anthracofibrosis attributed to mixed mineral dust

exposure: report of three cases. *Thorax*, 63(7):655–657.

Napp´ee, J., Bobrie, J., and Lambard, D. (1972). [pneumoconiosis due to cerium].

*Arch Mal Prof*, 33(1):13–18.

Nemery, B. and Hoet, P. H. (2015). Humidifier disinfectant-associated interstitial

lung disease and the ardystil syndrome. *Am J Respir Crit Care Med*,

191(1):116–117.

Newman, L. S., Mroz, M. M., and Ruttenber, A. J. (2005). Lung fibrosis in plutonium

workers. *Radiat Res*, 164(2):123–131.

Oldenburger, D., Maurer, W. J., Beltaos, E., and Magnin, G. E. (1972). Inhalation

lipoid pneumonia from burning fats. a newly recognized industrial hazard. *JAMA*,

222(10):1288–1289.

Omae, K., Nakano, M., Tanaka, A., Hirata, M., Hamaguchi, T., and Chonan, T.

(2011). Indium lung–case reports and epidemiology. *Int Arch Occup Environ*

*Health*, 84(5):471–477

Ould Kadi, F., Mohammed-Brahim, B., Fyad, A., Lellou, S., and Nemery, B.

(1994). Outbreak of pulmonary disease in textile dye sprayers in algeria. *Lancet*,

344(8927):962–963.

Pairon, J. C., Roos, F., Iwatsubo, Y., Janson, X., Billon-Galland, M. A., Bignon, J.,

and Brochard, P. (1994). Lung retention of cerium in humans. *Occup Environ*

*Med*, 51(3):195–199.

Pairon, J. C., Roos, F., S´ebastien, P., Chamak, B., Abd-Alsamad, I., Bernaudin,

J. F., Bignon, J., and Brochard, P. (1995). Biopersistence of cerium in the human

respiratory tract and ultrastructural findings. *Am J Ind Med*, 27(3):349–358.

Philit, F., Etienne-Mastro¨ıanni, B., Parrot, A., Gu´erin, C., Robert, D., and Cordier,

J.-F. (2002). Idiopathic acute eosinophilic pneumonia: a study of 22 patients. *Am*

*J Respir Crit Care Med*, 166(9):1235–1239.

Pinheiro, G. A., Antao, V. C., Wood, J. M., and Wassell, J. T. (2008). Occupational

risks for idiopathic pulmonary fibrosis mortality in the united states. *Int J Occup*

*Environ Health*, 14(2):117–123.

Porru, S., Placidi, D., Quarta, C., Sabbioni, E., Pietra, R., and Fortaner, S. (2001).

The potencial role of rare earths in the pathogenesis of interstitial lung disease: a

case report of movie projectionist as investigated by neutron activation analysis.

*J Trace Elem Med Biol*, 14(4):232–236.

PROUDFIT, J. P., VAN ORDSTRAND, H. S., and MILLER, C. W. (1950). Chronic

lipid pneumonia following occupational exposure. *Arch Ind Hyg Occup Med*,

1(1):105–111.

Pujol, J. L., Barnon, G., Bousquet, J., Michel, F. B., and Godard, P. (1990).

Interstitial pulmonary disease induced by occupational exposure to paraffin.

*Chest*, 97(1):234–236.

Ribeiro, P. A., Giro, F., and Henriques, P. (2011). [a rich and blessed

professional illness - organizing pneumonia due to gold dust]. *Rev Port Pneumol*,

17(4):182–185.

Rom, W. N., Weiden, M., Garcia, R., Yie, T. A., Vathesatogkit, P., Tse, D. B.,

McGuinness, G., Roggli, V., and Prezant, D. (2002). Acute eosinophilic

pneumonia in a new york city firefighter exposed to world trade center dust. *Am*

*J Respir Crit Care Med*, 166(6):797–800.

Sabbioni, E., Pietra, R., Gaglione, P., Vocaturo, G., Colombo, F., Zanoni, M., and

Rodi, F. (1982). Long-term occupational risk of rare-earth pneumoconiosis. a

case report as investigated by neutron activation analysis. *Sci Total Environ*,

26(1):19–32

Safdar M, Mitchell JL, J. B. (2011). Smoking related lung disease in a non-smoker.

*Am J Respir Crit Care Med*, 183:A5663.

Sanchez-Ortiz, M., Cruz, M., Viladrich, M., Morell, F., and Mu˜noz, X. (2011).

Cryptogenic organizing pneumonia due to ortho-phenylenediamine. *Respiratory*

*Medicine CME*, 4(4):164–165.

Schauble, T. L. and Rich, E. A. (1994). Lymphocytic alveolitis in a crematorium

worker. *Chest*, 105(2):617–619.

Scott, J., Johnston, I., and Britton, J. (1990). What causes cryptogenic fibrosing

alveolitis? a case-control study of environmental exposure to dust. *BMJ: British*

*Medical Journal*, 301(6759):1015.

Serrano, M., Molina-Molina, M., Ramrez, J., Snchez, M., and Xaubet, A. (2006).

[airway-centered interstitial fibrosis related to exposure to fumes from cleaning

products]. *Arch Bronconeumol*, 42(10):557–559.

Sheu, B.-F., Lee, C.-C., Young, Y.-R., Li, L.-F., and Chang, S.-S. (2008).

Delayed-onset bronchiolitis obliterans with organising pneumonia associated with

massive acetic acid steam inhalation. *Thorax*, 63(6):570.

Shorr, A. F., Scoville, S. L., Cersovsky, S. B., Shanks, G. D., Ockenhouse, C. F.,

Smoak, B. L., Carr, W. W., and Petruccelli, B. P. (2004). Acute eosinophilic

pneumonia among us military personnel deployed in or near iraq. *JAMA*,

292(24):2997–3005.

Sigari, N. and Mohammadi, S. (2009). Anthracosis and anthracofibrosis. *Saudi Med*

*J*, 30(8):1063–1066.

Sine, C., Allan, P., Haynes, R., Scoville, S., Shuping, E., Hultman, A.,

and Osborn, E. (2011). Case series of 44 patients with idiopathic acute

eosinophilic pneumonia in the deployed military setting. *CHEST Journal*,

140(4 MeetingAbstracts):675A–675A.

Song, Y., Li, X., and Du, X. (2009). Exposure to nanoparticles is related to pleural

effusion, pulmonary fibrosis and granuloma. *Eur Respir J*, 34(3):559–567.

Stefano, F. D., Verna, N., Giampaolo, L. D., Boscolo, P., and Gioacchino, M. D.

(2003). Cavitating boop associated with myeloperoxidase deficiency in a floor

cleaner with an incidental heavy exposure to benzalkonium compounds. *J Occup*

*Health*, 45(3):182–184.

Sulotto, F., Romano, C., Berra, A., Botta, G. C., Rubino, G. F., Sabbioni, E., and

Pietra, R. (1986). Rare-earth pneumoconiosis: a new case. *Am J Ind Med*,

9(6):567–575

Tanaka, A., Hirata, M., Homma, T., and Kiyohara, Y. (2010). Chronic pulmonary

toxicity study of indium-tin oxide and indium oxide following intratracheal

instillations into the lungs of hamsters. *J Occup Health*, 52(1):14–22.

Taskar, V. S. and Coultas, D. B. (2006). Is idiopathic pulmonary fibrosis an

environmental disease? *Proc Am Thorac Soc*, 3(4):293–298.

Tomioka, R. and King, Jr, T. (1997). Gold-induced pulmonary disease: clinical

features, outcome, and differentiation from rheumatoid lung disease. *Am J Respir*

*Crit Care Med*, 155(3):1011–1020.

Travis, W. D., Costabel, U., Hansell, D. M., King, Jr, T. E., Lynch, D. A., Nicholson,

A. G., Ryerson, C. J., Ryu, J. H., Selman, M., Wells, A. U., Behr, J., Bouros, D.,

Brown, K. K., Colby, T. V., Collard, H. R., Cordeiro, C. R., Cottin, V., Crestani, B.,

Drent, M., Dudden, R. F., Egan, J., Flaherty, K., Hogaboam, C., Inoue, Y., Johkoh,

T., Kim, D. S., Kitaichi, M., Loyd, J., Martinez, F. J., Myers, J., Protzko, S., Raghu,

G., Richeldi, L., Sverzellati, N., Swigris, J., Valeyre, D., and , A. T. S. R. S. C. o. I.

I. P. (2013). An official american thoracic society/european respiratory society

statement: Update of the international multidisciplinary classification of the

idiopathic interstitial pneumonias. *Am J Respir Crit Care Med*, 188(6):733–748.

Turcotte, S. E., Chee, A., Walsh, R., Grant, F. C., Liss, G. M., Boag, A., Forkert,

L., Munt, P. W., and Lougheed, M. D. (2013). Flock worker’s lung disease:

natural history of cases and exposed workers in kingston, ontario. *Chest*,

143(6):1642–1648.

Vocaturo, G., Colombo, F., Zanoni, M., Rodi, F., Sabbioni, E., and Pietra, R. (1983).

Human exposure to heavy metals. rare earth pneumoconiosis in occupational

workers. *Chest*, 83(5):780–783.

Vogt, P., Spycher, M. A., and R¨ uttner, J. R. (1986). [pneumoconiosis caused by ”rare

earths” (cer-pneumoconiosis)]. *Schweiz Med Wochenschr*, 116(38):1303–1308.

Waring, P. M. and Watling, R. J. (1990). Rare earth deposits in a deceased

movie projectionist. a new case of rare earth pneumoconiosis? *Med J Aust*,

153(11-12):726–730.

Woo, O. H., Yong, H. S., Oh, Y.-W., Lee, S. Y., Kim, H. K., and Kang, E.-Y. (2007).

Respiratory bronchiolitis-associated interstitial lung disease in a nonsmoker:

radiologic and pathologic findings. *AJR Am J Roentgenol*, 188(5):W412–W414.

Wynn, G. J., Turkington, P. M., and O’Driscoll, B. R. (2008). Anthracofibrosis,

bronchial stenosis with overlying anthracotic mucosa: possibly a new

occupational lung disorder: a series of seven cases from one uk hospital. *Chest*,

134(5):1069–1073

Yoon, H. K., Moon, H. S., Park, S. H., Song, J. S., Lim, Y., and Kohyama, N. (2005).

Dendriform pulmonary ossification in patient with rare earth pneumoconiosis.

*Thorax*, 60(8):701–703.

Yousem, S. A. and Dacic, S. (2002). Idiopathic bronchiolocentric interstitial

pneumonia. *Mod Pathol*, 15(11):1148–1153

**PAP**

Abraham JL, McEuen DD. Inorganic particulates associated with pulmonary alveolar proteinosis: SEM and X-ray microanalysis results. Appl Pathol 1986;4:138–146.

Ben-Dov 1999

Briens 2002

Bonella 2011

Buechner HA, Ansari A. Acute silico-proteinosis. A new pathologic variant of acute silicosis in sandblasters, characterized by histologic features resembling alveolar proteinosis. Dis Chest 1969;55:274–278.

Cabot RC, Painter FM. Case records of the Massachusetts General Hospital: case 20102. N Engl J Med 1934;210:551–554.

Chapman EM. Acute silicosis. JAMA 1932;98:1439–1441.

Cummings KJ, Donat WE, Ettensohn DB, Roggli VL, Ingram P, Kreiss K. Pulmonary alveolar proteinosis in workers at an indium processing facility. Am J Respir Crit Care Med 2010;181:458-464.

Cummings KJ, Nakano M, Omae K, Takeuchi K, Chonan T, Xiao YL, Harley RA, Roggli VL, Hebisawa A, Tallaksen RJ, Trapnell BC, Day GA, Saito R, Stanton ML, Suarthana E, Kreiss K. Indium lung disease. Chest 2012;141:1512-1521.

Davidson 1969

Dawkins SA, Gerhard H, Nevin M. Pulmonary alveolar proteinosis: a possible sequel of NO2 exposure. J Occup Med 1991; 33: 638–41.

Esteban Palacio J, Champeaux A. Silicoproteinosis masquerading as community-acquired pneumonia. J Am Board Fam Pract 2000;13:376–378.

Goldstein 1998

Hosokawa 2004

Inoue 2008

Kariman 1984

Keller CA, Frost A, Cagle PT, Abraham JL. Pulmonary alveolar proteinosis in a painter with elevated pulmonary concentrations of titanium. Chest 1995;108:277–280.

Marchiori 2007

McCunney RJ, Godefroi R. Pulmonary alveolar proteinosis and cement dust: a case report. J Occup Med 1989;31:233–237.

McDonald JW, Alvarez F, Keller CA. Pulmonary alveolar proteinosis in association with household exposure to fibrous insulation material. Chest 2000;117:1813–1817.

McEuen DD, Abraham JL. Particulate concentrations in pulmonary alveolar proteinosis. Env Res 1978;17:334-339.

Miller RR, Churg AM, Hutcheon M, Lam S. Pulmonary alveolar proteinosis and aluminum dust exposure. Am Rev Respir Dis 1984; 130:312–315.

Owens MW, Kinasewitz GT, Gonzalez E. Case report: sandblaster’s lung with mycobacterial infection. Am J Med Sci 1988;295:554–557.

Ray RL, Salm R. A fatal case of pulmonary alveolar proteinosis. Thorax 1962;17:257–266.

Rosen 1958

Rubin E, Weisbrod GL, Sanders DE. Pulmonary alveolar proteinosis: relationship to silicosis and pulmonary infection. Radiology 1980;135:35–41.

Suratt 1977

Xiao YL, Cai HR, Wang YH, Meng FQ, Zhang DP. Pulmonary alveolar proteinosis in an indium-processing worker. Chin Med J (Engl) 2010;123:1347-1350.

Xiao YL, Xu KF, Li Y, Li Y, Li H, Shi B, Zhou KF, Zhou ZY, Cai HR. Occupational inhalational exposure and serum GM-CSF autoantibody in pulmonary alveolar proteinosis. Occup Environ Med 2015;72:504-512.

Xipell JM, Ham KN, Price CG, Thomas DP. Acute silicoproteinosis. Thorax 1977;32:104–111.

**Bronchiolar Disorders**

1. Ryu JH, Myers JL, Swensen SJ. Bronchiolar disorders. Am J Respir Crit Care Med 2003;168:1277–92.

2. Visscher DW, Myers JL. Bronchiolitis: the pathologist's perspective. Proc Am Thorac Soc 2006;3:41–7.

3. Couture C, Colby TV. Histopathology of bronchiolar disorders. Semin Respir Crit Care Med 2003;24: 489–98.

4. Poletti V, Costabel U. Bronchiolar disorders: classification and diagnostic approach. Semin Respir Crit Care Med 2003;24:457–64.

5. Timens W, Sietsma H, Wright JL. Chronic obstructive pulmonary disease and diseases of the airways. In: Hastleton P, Flieder DB, eds. Spenser’s Pathology of the Lung, 6th ed. Cambridge: Cambridge University Press; 2013: 605–660.

6. Fraenkel A. Ueber bronchiolitis fibrosa oliterans, nebst bemerkungen ϋber lungenhyperämie und indurierende pneumonia. Deutsches Arch f klin Med 1902;73:424.

7. Lowry T, Schuman LM. Silo-filler's disease; a syndrome caused by nitrogen dioxide. J Am Med Assoc 1956;162:153–60.

8. Darke CS, Wallack AJ. Bronchiolitis from nitrous fumes. Thorax 1958;13:327–33.

9. Moskowitz RL, Lyons HA, Cottle HR. Silo filler’s disease: clinical, physiologic and pathologic study of a patient. Am J Med 1964;36:457–62.

10. Horvath EP, doPico GA, Barbee RA, Dickie HA. Nitrogen dioxide-induced pulmonary disease: five new cases and a review of the literature. J Occup Med 1978;20:103–10.

11. Fleetham JA, Munt PW, Tunnicliffe BW. Silo-filler's disease. Can Med Assoc J 1978;119:482–4.

12. Epler GR. Silo filler’s disease: a new perspective. Mayo Clin Proc 1989; 64:368–70.

13. Becklake MR, Goldman HI, Bosman AR, Freed CC. The long-term effects of exposure to nitrous fumes. Am Rev Tuberc 1957;76:398–409.

14. Milne TS. Nitrogen dioxide inhalation and bronchiolitis obliterans. A review of the literature and report of a case. J Occup Med 1969;11:538–47.

15. Tse RL, Bockman AA. Nitrogen dioxide toxicity: report of four cases in firemen. JAMA 1970;212:1341–4.

16. Woodford DM, Coutu RE, Gaensler EA. Obstructive lung disease from acute sulfur dioxide exposure. Respiration 1979;38:238–45.

17. Kraut A, Lilis R. Chemical pneumonitis due to exposure to bromine compounds. Chest 1988; 94:208–10.

18. Ramirez RJ, Dowell AR. Silo-filler’s disease: nitrogen dioxide-induced lung injury. Long-term follow-up and review of the literature. Ann Intern Med 1971;74:569–76.

19. Zwemer FL Jr, Pratt DS, May JJ. Silo filler’s disease in New York State. Am Rev Respir Dis 1992;146:650–3.

20. Konichezky S, Schatter A, Ezri T, Bokenboim P, Geva D. Thionyl-chloride-induced lung injury and bronchiolitis obliterans. Chest 1993;104:971–973.

21. NIOSH. Health hazard evaluation report: International Bakers Services, Inc., South Bend, Indiana. By McConnell R and Hartle RW. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, NIOSH HETA Report No. 1985-171-1710; 1986.

22. Kreiss K, Gomaa A, Kullman G, Fedan K, Simoes EJ, Enright PL. Clinical bronchiolitis obliterans in workers at a microwave-popcorn plant. N Engl J Med 2002;347:330–8.

23. Akpinar-Elci M, Travis WD, Lynch DA, Kreiss K. Bronchiolitis obliterans syndrome in popcorn production plant workers. Eur Respir J 2004;24:298–302.

24. Kanwal R, Kullman G, Piacitelli C, et al. Evaluation of flavorings-related lung disease risk at six microwave popcorn plants. J Occup Environ Med 2006;48:149–57.

25. van Rooy F, Rooyackers JM, Prokop M, Houba R, Smit L, Heederik D. Bronchiolitis obliterans syndrome in chemical workers producing diacetyl for food flavorings. Am J Resp Crit Care Med 2007;176:498–504.

26. Cavalcanti Zdo R, Albuquerque Filho AP, Pereira CA, Coletta EN. Bronchiolitis associated with exposure to artificial butter flavoring in workers at a cookie factory in Brazil. J Bras Pneumol 2012;38:395–9.

27. Centers for Disease Control and Prevention (CDC). Obliterative bronchiolitis in workers in a coffee-processing facility - Texas, 2008-2012. MMWR Morb Mortal Wkly Rep. 2013;62:305–7.

28. Hubbs AF, Goldsmith WT, Kashon ML, et al. Respiratory toxicologic pathology of inhaled diacetyl in Sprague-Dawley rats. Toxicol Pathol 2008;36:330–44.

29. Morgan DL, Flake GP, Kirby PJ, Palmer SM. Respiratory toxicity of diacetyl in C57BL/6 mice. Toxicol Sci 2008;103:169–80.

30. Hubbs AF, Cumpston AM, Goldsmith WT, et al. Respiratory and olfactory cytotoxicity of inhaled 2,3-pentanedione in Sprague-Dawley rats. Am J Pathol 2012;181:829–44.

31. Morgan DL, Jokinen MP, Price HC, et al. Bronchial and bronchiolar fibrosis in rats exposed to 2,3-pentanedione vapors: implications for bronchiolitis obliterans in humans. Toxicol Pathol 2012;40:448–65.

32. Cullinan P, McGavin CR, Kreiss K, et al. Obliterative bronchiolitis in fibreglass workers: a new occupational disease? Occup Environ Med 2013;70:357–9.

33. Chen CH, Tsai PJ, Wang WC, Pan CH, Ho JJ, Guo YL. Obliterative bronchiolitis in workers laying up fiberglass-reinforced plastics with polyester resin and methylethyl ketone peroxide catalyst. Occup Environ Med 2013;70:675–6.

34. Cummings KJ, McCague AB, Kreiss K. Nonmalignant respiratory disease mortality in styrene-exposed workers. Epidemiology 2014;25:160–1.

35. Kreiss K. Occupational lung disease: from case reports to prevention. Chest 2013;143:1529–30.

36. Kern DG, Crausman RS, Durand KT, Nayer A, Kuhn C 3rd. Flock worker's lung: chronic interstitial lung disease in the nylon flocking industry. Ann Intern Med 1998;129:261–72.

37. Eschenbacher WL, Kreiss K, Lougheed MD, Pransky GS, Day B, Castellan RM. Nylon flock–associated interstitial lung disease. Am J Respir Crit Care Med 1999;159:2003–8.

38. Boag AH. Colby TV, Fraire AE, et al. The pathology of interstitial lung disease in nylon flock workers. Am J Surg Pathol 1999; 23(12):1539–45.

39. Kern DG, Kuhn C, Ely W, et al. Flock worker’s lung: Broadening the spectrum of clinicopathology, narrowing the spectrum of suspected etiologies. Chest 2000;117:251–9.

40. Lougheed MD, Roos JO, Waddell WR, Mundt PW. Desquamative interstitial pneumonitis and diffuse alveolar damage in textile workers. Potential role of mycotoxins. Chest 1995;108:1196–1200.

41. Washko RM, Day B, Parker JE, Castellan RM, Kreiss K. Epidemiologic investigation of respiratory morbidity at a nylon flock plant. Am J Ind Med 2000;38:628–38.

42. Daroowalla F, Wang M-L, Piacitelli C, Attfield MD, Kreiss K. Flock workers’ exposures and respiratory symptoms in five plants. Am J Ind Med 2005;47:144–52.

43. Barroso E, Ibañez MD, Aranda FI, Romero S. Polyethylene flock-associated interstitial lung disease in a Spanish female. Eur Respir J 2002;20:1610–2.

44. Atis S, Tutluoglu B, Levent E, et al. The respiratory effects of occupational polypropylene flock exposure. Eur Respir J 2005;25:110–7.

45. Antao VC, Piacitelli CA, Miller WE, Pinheiro GA, Kreiss K. Rayon flock: a new cause of respiratory morbidity in a card processing plant. Am J Ind Med 2007;50:274–84.

46. Thomason JW, Rice TW, Milstone AP. Bronchiolitis obliterans in a survivor of a chemical weapons attack. J Am Med Assoc 2003;290:598–9.

47. Dompeling E, Jöbsis Q, Vandevijver NM, Wesseling G, Hendriks H. Chronic bronchiolitis in a 5-yr-old child after exposure to sulphur mustard gas. Eur Respir J 2004;23:343–6.

48. Ghanei M, Mokhtari M, Mohammad MM, Aslani J. Bronchiolitis obliterans following exposure to sulfur mustard: chest high resolution computed tomography. Eur J Radiol 2004;52:164–9.

49. Beheshti J, Mark EJ, Akbaei HM, Aslani J, Ghanei M. Mustard lung secrets: long term clinicopathological study following mustard gas exposure. Pathol Res Pract 2006;202:739–44.

50. Ghanei M, Tazelaar HD, Chilosi M, et al. An international collaborative pathologic study of surgical lung biopsies from mustard gas-exposed patients. Respir Med 2008;102:825–30.

51. Mann JM, Sha KK, Kline G, et al. World Trade Center dyspnea: bronchiolitis obliterans with functional improvement: a case report. Am J Ind Med 2005;48:225–9.

52. Wu M, Gordon RE, Herbert R, et al. Case report: Lung disease in World Trade Center responders exposed to dust and smoke: carbon nanotubes found in the lungs of World Trade Center patients and dust samples. Environ Health Perspect 2010;118:499–504.

53. Caplan-Shaw CE, Yee H, Rogers L, Abraham JL, et al. Lung pathologic findings in a local residential and working community exposed to World Trade Center dust, gas, and fumes. J Occup Environ Med 2011;53:981–91.

54. Wright JL, Cagle P, Churg A, Colby TV, Myers J. Diseases of the small airways. Am Rev Respir Dis 1992;146:240–62.

55. Seaton A. Bronchiolar disease. In: Seaton A, Seaton D, Leitch AG, eds. Crofton and Douglas’s Respiratory Disease, 5th ed. London: Wiley Inc.; 2008: 829–38.

56. Stansbury RC, Beeckman-Wagner LA, Wang ML, Hogg JP, Petsonk EL. Rapid decline in lung function in coal miners: evidence of disease in small airways. Am J Ind Med 2013;56:1107–12.

57. Mendelson DS, Roggeveen M, Levin SM, Herbert R, de la Hoz RE. Air trapping detected on end-expiratory high-resolution computed tomography in symptomatic World Trade Center rescue and recovery workers. J Occup Environ Med 2007;49:840–5.

58. Weiden MD, Ferrier N, Nolan A, et al. Obstructive airways disease with air trapping among firefighters exposed to World Trade Center dust. Chest 2010;137:566–74.

59. Friedman SM, Maslow CB, Reibman J, et al. Case–control study of lung function in World Trade Center health registry area residents and workers. Am J Respir Crit Care Med 2011;184:582–9.

60. Berger KI, Reibman J , Oppenheimer BW , Vlahos I, Harrison D, Goldring RM. Lessons from the World Trade Center disaster. Airway disease presenting as restrictive dysfunction. Chest 2013;144:249–57.

61. King MS, Eisenberg R, Newman JH, et al. Constrictive bronchiolitis in soldiers returning from Iraq and Afghanistan. N Engl J Med 2011;365:222–30.

62. Morris MJ, Dodson DW, Lucero Pf, et al. Study of active duty military for pulmonary disease related to environmental deployment exposures (STAMPEDE). Am J Respir Crit Care Med 2014;190:77–84.

63. Cullinan P, Acquilla S, Ramana Dhara N, on behalf of the International Medical Commission on Bhopal. Persistent respiratory effects in survivors of the Bhopal disaster. Brit Med J 1997;314:338–43.

64. Dhara VR, Gassert TH. The Bhopal syndrome: Persistent questions about acute toxicity and management of gas victims. Int J Occup Environ Health 2002;8:380–6.

65. Sriramachari S. The Bhopal gas tragedy: An environmental disaster. Current Science 2004; 86:905–20.

66. Sanz P, Prat A. Toxicity in textile air-brushing in Spain. Lancet 1993;42:240.

67. Moya C, Anto JM, Newman Taylor AJ, et al. Outbreak of organizing pneumonia in textile printing sprayers. Lancet 1994;498–500.

68. Solé A, Cordero PF, Morales P, Martinez ME, Vera F, Moya C. Epidemic outbreak of interstitial lung disease in aerographics textile workers - the "Ardystil syndrome": a first year follow up. Thorax 1996;51:94–5.

69. Romero S, Hernández L, Gil J, Aranda I, Martín C, Sanchez-Payá J. Organizing pneumonia in textile printing workers: a clinical description. Eur Respir J 1998;11:265–71.

70. Ould F, Mohammed-Brahim B, Fyad A, Lellou S, Nemery B. Outbreak of pulmonary disease in textile dye sprayers in Algeria. Lancet 1994;344:962–3.

71. Camus P, Nemery B. A novel cause for bronchiolitis obliterans organizing pneumonia: exposure to paint aerosols in textile workshops. Eur Respir J 1998;11:259–62.

72. Kim KW, Ahn K, Yang HJ et al. Humidifier disinfectant–associated children’s interstitial lung disease. Am J Respir Crit Care Med 2014;189:48–56.

73. Kim HJ, Lee MS, Hong SB, et al. A cluster of lung injury cases associated with home humidifier use: an epidemiological investigation. Thorax 2014;69:703–8.

74. Hong SB, Kim HJ, Huh JW, et al. A cluster of lung injury associated with home humidifier use: clinical, radiological and pathological description of a new syndrome. Thorax. 2014;69:694–702.

75. Lee E, Seo JH, Kim HY, et al. Two series of familial cases with unclassified interstitial pneumonia with fibrosis. Allergy Asthma Immunol Res 2012;4:240–4.

76. Yang HJ, Kim HJ, Yu J, et al. Inhalation toxicity of humidifier disinfectants as a risk factor of children’s interstitial lung disease in Korea: a case-control study. PLoS ONE. 2013;8:e64430.

77. Park S, Lee K, Lee EJ, et al. Humidifier disinfectant–associated interstitial lung disease in an animal model induced by polyhexamethylene guanidine aerosol. Am J Respir Crit Care Med 2014;190:706–8.

78. King TE Jr. Bronchiolitis obliterans. Lung. 1989;167:69–93.

79. Barker AF, Bergeron A, Rom WN, Hertz MI. Obliterative bronchiolitis. N Engl J Med 2014;370:1820–8.

80. King TE. Miscellaneous causes of bronchiolitis: inhalational, infectious, drug-induced, and idiopathic. Seminars in Respir Crit Care Med 2003;24:567–76.

81. Mathews JM, Watson SL, Snyder RW, Burgess JP, Morgan DL. Reaction of the butter flavorant diacetyl (2,3-butanedione) with N-α-acetylarginine: a model for epitope formation with pulmonary proteins in the etiology of obliterative bronchiolitis. J Agric Food Chem. 2010;58:12761–8.

82. More SS, Raza A, Vince R. The butter flavorant, diacetyl, forms a covalent adduct with 2 deoxyguanosine, uncoils DNA, and leads to cell death. J Agric Food Chem. 2012;60:3311–7.

83. Amicarelli F, Colafarina S, Cattani F, et al. Scavenging system efficiency is crucial for cell resistance to ROS-mediated methylglyoxal injury. Free Radic Biol Med. 2003;35:856–71.

84. Matsunaga T, Kamiya T, Sumi D, Kumagai Y, Kalyanaraman B, Hara A. L-Xylulose reductase is involved in 9,10-phenanthrenequinone-induced apoptosis in human T lymphoma cells. Free Radic Biol Med 2008;44:1191–202.

85. Brouwers O, Niessen PM, Haenen G, et al. Hyperglycaemia-induced impairment of endothelium-dependent vasorelaxation in rat mesenteric arteries is mediated by intracellular methylglyoxal levels in a pathway dependent on oxidative stress. Diabetologia. 2010;53:989–1000.

86. Hubbs AF, Fluharty KL, Goravanahally MP, et al. Diacetyl-Induced respiratory and olfactory toxicity in mice: Influence of ubiquitination, gender and dicarbonyl/L-xylulose reductase gene knockout. Toxicol Sci (The Toxicologist) 2013;132(S1):50.

87. Palmer SM, Flake GP, Kelly FL, et al. Severe airway epithelial injury, aberrant repair and bronchiolitis obliterans develops after diacetyl instillation in rats. PLoS One. 2011;6:e17644.

88. Kelly FL, Kennedy VE, Jain R, et al. Epithelial clara cell injury occurs in bronchiolitis obliterans syndrome after human lung transplantation. Am J Transplant 2012;12:3076–84.

89. Aoshiba K, Tsuji T, Itoh M, et al. A murine model of airway fibrosis induced by repeated naphthalene exposure.Exp Toxicol Pathol 2014;66:169–77.

90. Ghio AJ, Funkhouser W, Pugh CB, et al. Pulmonary fibrosis and ferruginous bodies associated with exposure to synthetic fibers. Toxicol Pathol 2006;34:723–9.

91. Epler G. Bronchiolitis obliterans organizing pneumonia, 25 years: a variety of causes, but what are the treatment options? Expert Rev Respir Med 2011;5:353–61.

92. Douglas WW, Hepper NG, Colby TV. Silo-filler’s disease. Mayo Clin Proc 1989;64:291–304.

93. Markopoulou KD, Cool CD, Elliot TL, et al. Obliterative bronchiolitis: varying presentations and clinicopathological correlation. Eur Respir J 2002;19:20–30.

94. Alleman T, Darcey DJ. Case report: bronchiolitis obliterans organizing pneumonia in a spice process technician. J Occup Environ Med 2002;44:215–6.

95. Morris MJ, Zacher LL. Constrictive bronchiolitis in soldiers. N Engl J Med 2011;365:1743–4.

96. Kuschner WG. Constrictive bronchiolitis in soldiers. N Engl J Med 2011;365:1744.

97. Cummings KJ, Boylstein RJ, Stanton ML, et al. Respiratory symptoms and lung function abnormalities related to work at a flavouring manufacturing facility. Occup Environ Med 2014;71:549–54.

98. Weiland DA, Lynch DA, Jensen SP, et al. Thin-section CT findings in flock worker’s lung, a work-related interstitial lung disease. Radiol 2003;227:222–31.

99. Di Stefano F, Verna N, Di Giampaolo L, Boscolo P, Di Gioacchino M. Cavitating BOOP associated with myeloperoxidase deficiency in a floor cleaner with an incidental heavy exposure to benzalkonium compounds. J Occup Health 2003;45:182–4.

100. Devakonda A, Raoof S, Sung A,Travis WD, Naidich D. Bronchiolar disorders: A clinical-radiological diagnostic algorithm. Chest 2010;137:938–51.

101. Ryu J. Classification and approach to bronchiolar diseases. Curr Opin Pulm Med 2006;12:145–51.

102. Chester EH, Kaimal PJ, Payne CB, Kohn PM. Pulmonary injury following exposure to chlorine gas possible beneficial effects of steroid treatment. Chest 1977;72:247–50.

103. Epler GR, Colby TV, McLoud TC, Carrington CB, Gaensler EA. Bronchiolitis obliterans organizing pneumonia. N Engl J Med 1985;312:152–8.

104. Spagnolo P, Fabbri LM, Bush A. Long-term macrolide treatment for chronic respiratory disease. Eur Respir J 2013;42:239–51.

105. Shohrati M, Karimzadeh I, Saburi A, Khalili H, Ghanei M. The role of N-acetylcysteine in the management of acute and chronic pulmonary complications of sulfur mustard: a literature review. Inhal Toxicol 2014;26:507–23.

106. Lai RS, Wang JS, Wi MT, Hsu HK. Lung transplantation in bronchiolitis obliterans associated with vegetable consumption. Lancet 1998;352:117–8.

107. Kreiss K. Flavoring-related bronchiolitis obliterans. Curr Opin Allergy Clin Immunol 2007;7:162–7.

108. Jones RN, Hughes JM, Glindmeyer H, Weill H. Lung function after acute chlorine exposure. Am Rev Respir Dis 1986;134:1190–5.

109. Close LG, Catlin FI, Cohn AM. Acute and chronic effects of ammonia burns on the respiratory tract. Arch Otolaryngol 1980;106:151–8.

110. Aldrich TK, Gustave J, Hall CB, et al. Lung function in rescue workers at the World Trade Center after 7 years. N Engl J Med 2010;362:1263–72.

111. van Rooy FG, Smit LA, Houba R, et al. A cross-sectional study of lung function and respiratory symptoms among chemical workers producing diacetyl for food flavourings. Occup Environ Med 2009; 66:105–10.

112. Halldin CN, Suarthana E, Fedan KB, Lo YC, Turabelidze G, Kreiss K. Increased respiratory disease mortality at a microwave popcorn production facility with worker risk of bronchiolitis obliterans. PLoS One 2013;8:e57935.

113. Turcotte SE, Chee A, Walsh R, Grant FC, Liss GM, Boag A, Forkert L, Munt PW, Lougheed MD. Flock worker’s lung: Natural history of cases and exposed workers in Kingston, Ontario. Chest 2013; 143:1642–8.

114. Kern DG, Kern E, Crausman RS, Clapp RW. A retrospective cohort study of lung cancer incidence in nylon flock workers, 1998–2008. Int J Occup Environ Health 2011;17:345–51.

115. Kadi OF, Abdesslam T, Nemery B. Five-year follow-up of Algerian victims of the "Ardystil syndrome." Eur Respir J 1999;13 940–1.

116. Oppenheimer BW, Goldring RM, Herberg ME, et al. Distal airway function in symptomatic subjects with normal spirometry following World Trade Center dust exposure. Chest 2007; 132:1275–82.

117. Todd JL, Wang X, Sugimoto S, et al. Hyaluronan contributes to bronchiolitis obliterans syndrome and stimulates lung allograft rejection through activation of innate immunity. Am J Respir Crit Care Med 2014:189:556–66.

118. Kelly FL, Sun J, Fischer BM, et al. Diacetyl induces amphiregulin shedding in pulmonary epithelial cells and in experimental bronchiolitis obliterans. Am J Respir Cell Mol Biol 2014;in press.

119. Nord M, Schubert K, Cassel TN, Andersson O, Riise GC. Decreased serum and bronchoalveolar lavage levels of Clara cell secretory protein (CC16) is associated with bronchiolitis obliterans syndrome and airway neutrophilia in lung transplant recipients. Transplantation 2002;73:1264–9.

120. Ziegenhagen MW, Zabel P, Zissel G, Schlaak M, Müller-Quernheim J. Serum level of interleukin 8 is elevated in idiopathic pulmonary fibrosis and indicates disease activity. Am J Respir Crit Care Med 1998;157(3 Pt 1):762–8.

121. Egilman DG, Mailloux C, Valentin C. Popcorn-worker lung caused by corporate and regulatory negligence: An avoidable tragedy. Int J Occup Environ Health 2007;13:85–98.

122. Kass I, Zamel N, Dobry CA, Holzer M. Bronchiectasis following ammonia burns of the respiratory tract. Chest 1972;62:282–5.

123. Monforte V, Roman A, Gavalda J, et al. Nebulized amphoterician B concentration and distribution in the respiratory tract of lung-transplanted patients. Transplantation 2003;75:1571–4.

124. Sobonya R. Fatal anhydrous ammonia inhalation. Hum Pathol 1977;8:293–9.

125. Simpson FG, Belfield PW, Cooke NJ. Chronic airflow limitation after inhalation of overheated cooking oil fumes. Postgrad Med J 1985;61:1001–2.

126. Sue MA. A moviemaker's malady. N Engl J Med 1999;340:897.

127. Boswell RT, McCunney RJ. Bronchiolitis obliterans from exposure to incinerator fly ash. J Occup Environ Med 1995;37:850–5.

128. Spain BA, Cummings O, Garcia JG. Bronchiolitis obliterans in an animal feed worker. Am J Indust Med 1995;28:437–43.

129. Arnold IMF, Dufresne RM, Alleyne BC, Stuart PJ. Health implication of occupational exposures to hydrogen sulfide. J Occup Med 1985;27:373–6.

130. Parra O, Monso E, Gallego M, Morera J. Inhalation of hydrogen sulphide: a case of subacute manifestations and long term sequelae. Brit J Indust Med 1991;48:286–7.

131. Richardson DB. Respiratory effects of chronic hydrogen sulfide exposure. Am J Ind Med 1995;28:99–108.

132. Doujaiji B, Al-Tawfiq JA. Hydrogen sulfide exposure in an adult male. Ann Saudi Med 2010;30:76–80.

133. Weill H. Disaster at Bhopal: the accident, early findings and respiratory health outlook in those injured. Bull Eur Physiopathol Respir 1987;23:587–90.

134. Mishra PK, Samarth RM, Pathak N, Jain SK, Banerjee S, Maudar KK. Bhopal gas tragedy: review of clinical and experimental findings after 25 years. Int J Occup Med Environ Health 2009;22:193–202.

135. Figueiredo S, Morais A, Magalhães A, et al. Occupational constrictive bronchiolitis with normal physical, functional and image findings. Rev Port Pneumol 2009;15:729–32.

136. Grayson RR. Silage gas poisoning: nitrogen dioxide pneumonia, a new disease in agricultural workers. Ann Int Med 1956;45:393–408.

137. Yockey CC, Eden BM, Byrd RB. The McConnell missile accident: Clinical spectrum of nitrogen dioxide exposure. J Am Med Assoc 1980;244:1221–3.

138. Borak J, Diller WF. Phosgene exposure: mechanisms of injury and treatment strategies.

J Occup Environ Med 2001;43:110–9.

139. Lai RS, Chiang AA, Wu MT, et al. Outbreak of bronchiolitis obliterans associated with consumption of Sauropus androgynus in Taiwan. Lancet. 1996;348:83–5.

140. LaDue JS. Bronchiolitis fibrosa obliterans. Ann Int Med 1941; 68:663–73.

141. Seggev JS, Mason UG, Worthen S, Stanford RE, Fernandez E. Bronchiolitis obliterans: Report of three cases with detailed physiologic studies. Chest 1983;83:169–74.

142. Tasaka S, Kanazawa M, Mori M, et al. Long-term course of bronchiectasis and bronchiolitis obliterans as late complication of smoke inhalation. Respiration 1995;62:40–2.

143. Janigan DT, Kilp T, Michael R, McCleave JJ. Bronchiolitis obliterans in a man who used his wood-burning stove to burn synthetic construction materials. Can Med Assoc J 1997;156:1171–3.

144. Charan NB, Myers CG, Lakshminarayan S, Spencer TM. Pulmonary injuries associated with acute sulphur dioxide inhalation. Am Rev Respir Dis 1979;119:555-60.

145. Weinberger B, Laskin JD, Sunil V, Sinko PJ, Heck DE, Laskin DL. Sulfur mustard-induced pulmonary injury: therapeutic approaches to mitigating toxicity. Pulm Pharmacol Ther 2011;24:92-9.

146. Tang FR, Loke WK. Sulfur mustard and respiratory diseases. Crit Rev Toxicol 2012;42:688-702.