ENVIRONMENTAL HEALTH PROJECT

AN ANNOTATED BIBLIOGRAPHY ON

Prevention of Acute Respiratory Infections (ARI) and Indoor Air Pollution

(With Emphasis on Children in Developing Countries)

JUNE 1997

Prepared by
John P. McCracken and Kirk R. Smith
Environmental Health Sciences, School of Public Health
University of California, Berkeley, CA 94720-7360

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
BUREAU FOR GLOBAL PROGRAMS, FIELD SUPPORT AND RESEARCH
CENTER FOR POPULATION, HEALTH AND NUTRITION
OFFICE OF HEALTH AND NUTRITION, WASHINGTON,

USAID

ENVIRONMENTAL HEALTH PROJECT
1611 N. KENT ST., SUITE 300, ARLINGTON, VA 22209
PHONE (703) 247-8730 FAX (703) 243-9004
INTERNET: campbelldb@ehproject.org
WEB SITE: www.ehproject.org

Prevention of Acute Respiratory Infections (ARI) and Indoor Air Pollution

Contents

Introduction

In July 1997, the second International Conference on Acute Respiratory Infections was held in Canberra, Australia (http://nceph.anu.edu.au/user/md868/aricon.html#THE) thirteen years after the first in 1984 (Douglas & Kerby-Eaton, 1985). Although the first conference included papers on environmental risk factors for ARI, in the second there was unfortunately not one paper or plenary presentation on these factors in developing countries, and only one session out of 34 on the topic in developed countries. This is partly due to a perception in the ARI professional community that little progress has been made in understanding this complicated set of issues. Wishing to dispel this image, although recognizing that there is still much room for additional work, we offer this bibliography of material related to air pollution and childhood ARI in developing countries, the vast bulk of which has been published in the period between the two conferences.

This bibliography contains 192 references pertaining to air pollution as a risk factor for acute respiratory infections (ARI). The focus is ARI in young developing-country children, who bear the greatest burden of ill-health from ARI worldwide and many of whom seem to have high exposures to a number of harmful air pollutants. A major purpose of the bibliography is to provide an easily accessed source of information on the relationship between ARI and air pollution to researchers and field staff in developing countries, where access to current publications may be limited. For this reason, abstracts have been included whenever available.

The references, which date from 1968-1997, have been collected from several databases, including Medline, Cambridge Abstracts, and the library database of the Environmental Health Project (EHP/USAID). Also included are reports, conference summaries, and other unpublished works from our collection at the University of California. The current work represents a substantial expansion and reorganization of the draft *EHP Annotated Bibliography on Acute Respiratory Infections* (1996).

Four principal criteria have been applied to choose references:

Children under 5 years
Developing countries
Indoor air pollution
Confirmed Acute Lower Respiratory Infection or pneumonia

All references meeting at least three of these criteria were included. In some cases, references meeting only two criteria were also included. Examples of the latter are epidemiological studies from developed countries that provide ARI dose-response information for ambient air pollution; studies from developing countries that only look at respiratory symptoms in children, rather than confirmed ARI; and woodsmoke studies in developed countries addressing ill-health in children of any age In addition studies are included that address developing-country indoor air pollution and either perinatal effects (low birthweight, stillbirth, etc.) in infants whose mothers were exposed during pregnancy or chronic obstructive lung disease in adults, which may be, respectively, either a risk factor for or an outcome of childhood ARI. These may aid in interpreting studies and designing interventions that relate directly to childhood ARI and indoor air pollution.

Unless otherwise qualifying, not usually included are studies of asthma or chronic lung diseases; studies reporting indoor air quality and/or exposures but no health effects; studies before 1985 focusing on effects of gas stove use in developed countries; and studies solely on the effects of environmental tobacco smoke (ETS).

The first section is the **Subject List,** which lists the subject headings by which the bibliography is organized. This has been kept short and in general does not include the primary criteria listed above. Geographic designations are those used in the Global Burden of Disease databases of V,THO/IBRD/Harvard (see, for example, Murray, C.J.L. & A.L. Lope4 *Global Burden of Disease,* Harvard University Press, Cambridge, 1996). Next is the **Subject Index,** which lists the full reference citations but no abstracts. Many references will be found in more than one section of the Subject Index, of course, because references have been placed in all the categories to which they apply. The **Author Index** provides full citations and abstracts, where available, in alphabetical order by first author.

Comments on the usefulness of the bibliography and suggestions of how it may be improved as well as leads to additional referencesfor inclusion are welcomed. Please contact Kirk R. Smith at: krksmith@uclink4.berkeleyedu orfax: 510-642-5815.

Subject List

An Annotated Bibliography on Prevention of Acute Respiratory Infections (ARI) and Indoor Air Pollution

(With Emphasis on Children in Developing Countries)

December 1997

Prepared by
John P. McCracken and Kirk R. Smith
Environmental Health Sciences, School of Public Health
University of California, Berkeley, CA 94720-7360

Check our website at www.ehproject.org for information about joining the EHP ARI Network or contact:
campbelldb@ehproject.org

SUBJECT INDEX

ACUTE UPPER RESPIRATORY INFECTIONS

Braun-Fahrlander, C., Ackermann-Liebrich, U., Schwartz, J., Gnehm, H. P., Rutishauser, M., & Wanner, H. U. (1992). **Air pollution and respiratory symptoms in preschool children.** *Am Rev Respir Dis* 145(l):42-7.

Browning, K.G., Koenig, J., Checkoway, H., Larson, T., Pierson, W.E. (1990). A **questionnaire study of respiratory health in areas of high and low ambient wood smoke pollution.** *Pediatric Asthma, Allergy & Immunology* 4(3):183- 191.

Butterfield, P., Edmundson, E., LaCava, G., & Penner, J. (1989). **Woodstoves and indoor air: the effects on preschooler's upper respiratory systems.** *Journal ofEnvironmental Health* 52(3):172-3.

He, Q. C., Lioy, P. J., Wilson, W. E., & Chapman, R. S. (1993). **Effects of air pollution on children's pulmonary function in urban and suburban areas of Wuhan, People's Republic of China.** *Arch Environ Health* 48(6):382-91.

Koenig, J. Q. (1988). **Indoor and outdoor pollutants and the upper respiratory tract.** *J Allergy Clin Immunol* 81(5 Pt 2):1055-9.

Koltai, P. J. (1994). **Effects of air pollution on the upper respiratory tract of children.** *Otolaryngol Head Neck Surg* 111(1):9-11.

Ponka, A. (1990). **Absenteeism and respiratory disease among children and adults in Helsinki in relation to low-level air pollution and temperature.** *Environ Res* 52(l):34-46.

Samet, J. M., Lambert, W. E., Skipper, B. J., Cushing, A. H., Hunt, W. C., Young, S. A., McLaren, L. C., Schwab, M., & Spengler, J. D. (1993). **Nitrogen dioxide and respiratory illness in children. Part 1: Health outcomes.** *Res Rep Health Eff Inst* (58):1-32; discussion 51-80.

Schwartz, J., Dockery, D. W., Neas, L. M., Wypij, D., Ware, J. H., Spengler, J. D., Koutrakis, P., Speizer, F. E., & Ferris, B. G., Jr. (1994). **Acute effects of summer air pollution on respiratory symptom reporting in children.** *Am J Respir Crit Care Med* 150(5 Pt 1):1234-42.

Terblanche, A. P., Opperman, L., Nel, C. M., Reinach, S. G., Tosen, G., & Cadman, A. (1992). **Preliminary results of exposure measurements and health effects of the Vaal Triangle Air Pollution Health Study.** S *Afr Med J* 81(11):550- 6.

CHILDREN - FIVE TO FIEFTEEN YEARS

(1993). **American Academy of Pediatrics Committee on Environmental Health: Ambient air pollution: respiratory hazards to children.** *Pediatrics* 9(6):1210-3.

Azizi, B. H., & Henry, R. L. (1990). **Effects of indoor air pollution on lung function of primary school children in Kuala Lumpur.** *Pediatr Pulmonol* 9(l):24-9.

Azizi, B. H., & Henry, R. L. (1991). **The effects of indoor environmental factors on respiratory illness in primary school children in Kuala Lumpur.** *Int J Epidemiol* 20(l):144-50.

Berwick, M. (1984). **Respiratory illness in children exposed to unvented combustion sources.** In B.B. & L.T. (Eds.), *Radon, passive smoking, particulates and housing epidemiology* (pp. 255-260). Stockholm, Sweden: Swedish Council for Building Research.

Colley, J. R., Douglas, J. W., & Reid, D. D. (1973). **Respiratory disease in young adults: influence of early childhood lower respiratory tract illness, social class, air pollution, and smoking.** *Br Med J* 3(873):195-8.

deKoning, H. (1987). **Rural energy and health of children.** *AdvInt Mat& Child Health* 7:130-137.

Dockery, D. W., Speizer, F. E., Stram, D. 0., Ware, J. H., Spengler, J. D., & Ferris, B. G., Jr. (1989). **Effects of inhalable particles on respiratory health of children.** *Am Rev Respir Dis* 139(3):587-94.

Dodge, R. (1982). **The effects of indoor pollution on Arizona children.** *Arch Environ Health* 3 7(3):151-5.

Gharaibeh, N. S. (1996). **Effects of indoor air pollution on lung function of primary school children in Jordan.** Ann *Trop Paediatr* 16(2):97-102.

Goren, A. I., Heilman, S., Brenner, S., Egoz, N., & Rishpon, S. (1990). **Prevalence of respiratory conditions among schoolchildren exposed to different levels of air pollutants in the Haifa Bay area, Israel.** *Environ Health Perspect* 89:225-31.

Goren, A. I., & Hellmann, S. (1995). **Respiratory conditions among schoolchildren and their relationship to environmental tobacco smoke and other combustion products.** *Arch Environ Health* 50(2):112-8.

Guneser, S., Atici, A., Alparslan, N., & Cinaz, P. (1994). **Effects of indoor environmental factors on respiratory systems of children.** *J Trop Pediatr* 40(2):114-6.

He,Q. C., LioyP. J., Wilson, W.E., & Chapman, R. S. (1993). **Effects of air pollution on children's pulmonary function in urban and suburban areas of Wuhan, People's Republic of China.** Arch *Environ Health* 48(6):382-91.

Herbarth, 0. (1995). **Risk assessment of environmentally influenced airway diseases based on time-series analysis.** *Environ Health Perspect* 103 (9):852-6.

Heumann, M., Foster, L, Johnson, L., & Kelly, W. (1991). **Woodsmoke air pollution and changes in pulmonaryfunction among elementary school children.** Portland: Oregon Health Division, Office of Epidemiology.

Hoek, G., & Brunekreet B. (1995). **Effect of photochemical air pollution on acute respiratory symptoms in children.** *Am JRespir Crit Care Med* 151(1):27-32.

Honicky, R.E., & Osborne, J. S. d. (1991). **Respiratory effects of wood heat: clinical observations and epidemiologic assessment.** *Environ Health Perspect* 95:105-9.

Jedrychowski, W., Flak, E., & Mroz, E. (1995). **[Prospective epidemiologic study on respiratory diseases in children in Cracow. Pilot study].** *Przegl Epidemiol* 49(3):331-9.

Jedrychowski, W., Flak, E., & Mroz, E. (1996). **[Variability of respiratory system reactions to air pollutants. Epidemiologic study of children in Cracow].** P*neumonolAlergol Pol* 64(5-6):267-75.

Koenig, J. Q., Larson, T. V., Hanley, Q. S., Rebolledo, V., Dumler, K., Checkoway, H., Wang, S. Z., Lin, D., & Pierson, W. E. (1993). **Pulmonary function changes in children associated with fine particulate matter.** *Environ Res* 63(1):26-38.

Koltai, P. J. (1994). **Effects of air pollution on the upper respiratory tract of children.** O*tolaryngol Head Neck Surg,* 111(1):9-11.

Larson, T. V., & Koenig, J. Q. (1994). **Wood smoke: emissions and noncancer respiratory effects.** *Annu Rev Public Health* 15:133-56.

Leigh, M.W., Carson, J.L, & Denny, F.W., Jr. (1991). **Pathogenesis of respiratory infections due to influenza virus: implications for developing countries.** *Rev Infect Dis* 13 Suppl 6:S501-8.

Lercher, P., Schmitzberger, R., & Kofler, W. (1995). **Perceived traffic air pollution, associated behavior and health in an alpine area.** Sci *Total Environ* 169(1-3):71-4.

Lunn, J. E., Knowelden, J., & Handyside, A. J. (1967). **Patterns of respiratory illness in Sheffield infant schoolchildren** . *Br J Prev Soc Med* 21(1):7-16.

Mazur, B. (1995). **Peak expiratory flow values in children relative to the degree of atmospheric air pollution** *Acta Paediatr* 84(2):203-5.

Narain, J. P. (1987). **Epidemiology of acute respiratory infections.** *Indian JPediatr* 54(2):153-60.

Neas, L. M., Dockery, D. W., Koutrakis, P., Tollerud, D. J., & Speizer, F. E. (1995). **The association of ambient air pollution with twice daily peak expiratory flow rate measurements in children.** Am *JEpidemiol* 141(2):111-22.

Neas, L. M., Dockery, D. W., Burge, R, Koutrakis, P., & Speizer, F. E. (1996). **Fungus spores, air pollutants, and other determinants of peak expiratory flow rate in children.** Am *JEpidemiol* 143(8):797-807.

Pandey, M. R., Boleij, J. S., Smith, KR., & WafiilaE.M. (1989). **Indoor air pollution in developing countries and acute respiratory infection in children.** *Lancet* 1(8635):427-9.

Ponka, A. (1990). **Absenteeism and respiratory disease among children and adults in Helsinki in relation to low-level air pollution and temperature.** *Environ Res* 52(l):34-46.

Pope, C. A. d., Dockery, D. W., Spengler, J. D., & Raizenne, M. E. (1991). **Respiratory health and PM10 pollution. A daily time series analysis.** *Am Rev Respir Dis* 144(3 Pt 1):668-74.

Pope, C. A. d., & Dockery, D. W. (1992). **Acute health effects of PM10 pollution on symptomatic and asymptomatic children.** *Am Rev RespirDis* 145(5):1123-8.

Raizenne, M., Neas, L. M., Damokosh, A. I., Dockery, D. W., Spengler, J. D., Koutrakis, P., Ware, J. H., & Speizer, F. E. (1996). **Health effects of acid aerosols on North American children: pulmonary function** . E*nviron Health Perspect* 104(5):506-14.

Ransom, M. R., &Pope, C. A. d. (1992). **Elementary school absences and PM10 pollution in Utah Valley.** *EnvironRes* 58(2):204-19.

Roemer, W., Hoek, G., & Brunekreef, B. (1993). **Effect of ambient winter air pollution on respiratory healthof children with chronic respiratory symptoms.** *Am Rev Respir Dis* 147(l):118-24.

Schwartz, J., Dockery, D. W., Neas, L. M., Wypij, D., Ware, J. H., Spengler, J. D., Koutrakis, P., Speizer, F. E., & Ferris, B. G., Jr. (1994). **Acute effects of summer air pollution on respiratory symptom reporting in children.** Am *JRespir Crit Care Med* 150(5 Pt 1):1234-42.

Sobral, H. R. (1989). **Air pollution and respiratory diseases in children in Sao Paulo, Brazil** . Soc Sci *Med* 29(8):959-64.

Sram, R.J., Benes, I., Binkova, B., Dejmek, J., Horstman, D., Kotesovec, F., Otto, D., Perreault, S. D., Rubes, J., Selevan, S.G., Skalik, I., Stevens, R. K., & Lewtas, J. (1996). **Teplice program—the impact of air pollution on human health.** *Environ Health Perspect* 104 Suppl 4:699-714.

Stern, B.R., Raizenne, M. E., Burnett, R. T., Jones, L, Kearney, J., & Franklin, C. A. (1994). **Air pollution and childhood respiratory health: exposure to sulfate and ozone in 10 Canadian rural communities.** *Environ Res* 66(2):125-42.

SurJadi, C. (1993). **Respiratory diseases of mothers and children and environmental factors among households in Jakarta.** *Environment and Urbanization* 5(2):78-86.

Tatotschenko, W. K., & Nesterenko, S. W. (1990). **[Effect of moderate pollutant concentrations in the air and incidence of respiratory diseases in children].** Z *Erkr Atmungsorgane* 174(3):185-9.

Terblanche, A. P., Opperman, L., Nel, C. M., Reinach, S. G., Tosen, G., & Cadman, A. (1992). **Preliminary results of exposure measurements and health effects of the Vaal Triangle Air Pollution Health Study.** S *Afr Med J* 81(11):550-6.

Tuthill, R. W. (1984). **Woodstoves, formaldehyde, and respiratory disease.** *Am JEpidemiol* 120(6):952-5.

Zwi, S., Davies, J. C., Becklake, M. R., Goldman, H. L, Reinach, S. G., & Kallenbach, J. M. (1990). **Respiratory health status of children in the eastern Transvaal highveld.** S*AfrMedJ* 78(11):647-53.

CHINA

Chen, B. H., Hong, C. J., Pandey, M. R., & Smith, K. R. (1990). **Indoor air pollution in developing countries.** *World Health Stat Q* 43(3):127-38.

Cui, J., & MacKay, R. (1993). **Effects of passive smoking on respiratory illness from birth to age eighteen months, in Shanghai, People's Republic of China.** *The Journal ofPediatrics* 123(4):553-8.

Florig, H. (1997). **China's air pollution risks.** *Environmental Science & Technology* 31(6):274A-279A.

He, Q. C., Lioy, P. J., Wilson, W. E., &Chapman, R. S. (1993). **Effects of air pollution on children's pulmonary function in urban and suburban areas of Wuhan, People's Republic of China.** Arch *Environ Health* 48(6):382-91.

Hong, C. (1991). **Health aspects of domestic use of biomass and coal in China.** Geneva: WHO.

Hu, H., & 11u, Y. (1989). **Evaluation of indoor air pollution and its effect on human health in Beijing's rural areas** *Environment International* 15(1/6):321.

Wang, X., Ding, H., Ryan, L., & Xu, X. (1997). **Association between air pollution and low birth weight: a community-based study.** *Environmental Health Perspectives* 105(5):514-520.

Xu, X., Dockery, D. W., Christiani, D. C., Li, B., & Huang, H. (1995). **Association of air pollution with hospital outpatient visits in Beijing.** *Arch Environ Health* 50(3):214-20.

Xu, X., Ding, H., & Wang, X. (1995). **Acute effects of total suspended particles and sulfur dioxides on preterm delivery: a community-based cohort study.** *Arch Environ Health* 50(6):407-15.

CHRONIC OBSTRUCTIVE LUNG DISEASE

Albalak, R. (1997). ***Culturalpractices and exposure to particulate pollutionfrom indoor biomass cooking: effects on respiratory health and nutritional status among the Aymara Indians of the Bolivian Highlands.*** Unpublished Doctoral Dissertation, University of Michigan.

Anderson, H. R. (1979). **Chronic lung disease in the Papua New Guinea Highlands.** *Thorax* 34(5):647-53.

Anderson, H. R. (1979). **Respiratory abnormalities, smoking habits and ventilatory capacity in a highland community in Papua New Guinea: prevalence and effect on mortality.** *IntJEpidemiol* 8(2):127-35.

Aunan, K (1996). **Exposure-response functions for health effects of air pollutants based on epidemiological findings** *RiskAnal* 16(5):693-709.

Azizi, B. H., Zulkifli, H. I., & Kasim, M. S. (1995). **Protective and risk factors for acute respiratory infections in hospitalized urban Malaysian children: a case control study.** *Southeast Asian J Trop Med Public Health* 26(2):280-5.

Behera, D., & Jindal, S. K. (1991). **Respiratory symptoms in Indian women using domestic cooking fuels.** *Chest* 100(2):385-8.

Chen, B. H., Hong, C. J., Pandey, M. R., & Smith, K. R. (1990). **Indoor air pollution in developing countries.** *World Health Stat Q* 43(3):127-38.

Dennis, R. J., Maldonado, D., Norman, S., Baena, E., Castano, H., Martinez, G., &Velez, J. R. (1996). **Wood smoke exposure and risk for obstructive airways disease among women.** *Chest* 109(3 Suppl):55S-56S.

Dennis, R. J., Maldonado, D., Norman, S., Baena, E., & Martinez, G. (1996). **Woodsmoke exposure and risk for obstructive airways disease among women.** *Chest* 109(l):115-9.

Dhar, S., & Pathania, A. (1991). **Bronchitis due to biomass fuel burning in North India: "Guijjar Lung," an extreme effect.** *Seminars in Respiratory Medicine* 12(2):69-74.

Dockery, D. W., Speizer, F. E., Stram, D. 0., Ware, J. H., Spengler, J. D., & Ferris, B. G., Jr. (1989). **Effects of inhalable particles on respiratory health of children.** *Am Rev Respir Dis* 139(3):587-94.

Dossing, M., Khan, J., & al-Rabiah, F. (1994). **Risk factors for chronic obstructive lung disease in Saudi Arabia** . R*espir Med* 88(7):519-22.

Ferris, B. G., Jr., Dockery, D. W., Ware, J. H., Speizer, F. E., & Spiro, R. d. (1983). **The Six-City Study: examples of problems in analysis of the data.** *Environ Health Perspect* 52:115-23.

Florig, H. (1997). **China's air pollution risks.** *Environmental Science & Technology* 31(6):274A-279A.

Guneser,S.,Atici,A.,Alparslar4N.,&Cinaz,P.(1994). **Effects of indoor environmental factors on respiratory systems of children.** *J Trop Pediatr* 40(2):114-6.

Hu, H., & 11u, Y. (1989). **Evaluation of indoor air pollution and its effect on human health in Beijing's rural areas** *Environment International* 15(1/6):321.

Malik, S.K (1985). **Exposure to domestic cooking fuels and chronic bronchitis.** *Indian J Chest Dis Allied Sci* 27(3):171-4.

Malik, S.K.(1985). **Cooking fuels and chronic respiratory disease [letter].** *JAssoc Physicians India* 33(5):378.

Marbury, M. C., Maldonado, G., & Waller, L. (1996). **The indoor air and children's health study: methods and incidence rates.** *Epidemiology* 7(2):166-74.

Menezes, A. M., Victora, C. G., & Rigatto, M. (1994). **Prevalence and risk factors for chronic bronchitis in Pelotas, RS, Brazil: a population-based study.** *Thorax* 49(12):1217-21.

Norboo,T., Yahya, M., Bruce, N.G., Heady, J. A.,& Ball, K. P. (1991). **Domestic pollution and respiratory illness in a Himalayan village.** *IntJEpidemiol* 20(3):749-57.

Pandey, M. (1984). **Domestic smoke pollution and chronic bronchitis in a rural community of the hill region of Nepal.** *Thorax,* 39, 337-339.

Perez-Padilla, R_, Regalado, J., Vedal, S., Pare, P., Chapela, R., Sansores, R., & Selman, M. (1996). **Exposure to biomass smoke and chronic airway disease in Mexican women. A case-control study.** *Am J Respir Crit Care Med,* 154(3 Pt 1), 701-6.

Pershagen,G.,Rylander,E.,Norberg,S.,Eriksson,M.,&Nordvall,S.L.(1995). **Air pollution involving nitrogen dioxide exposure and wheezing bronchitis in children.** *IntJEpidemiol,* 24(6), 1147-53.

Pope, C. A. d. (1989). **Respiratory disease associated with community air pollution and a steel mill, Utah Valley** . Am *J Public Health,* 79(5), 623-8.

Sandoval, J., Salas, J., Martinez-Guerra, M. L, Gomez, A., Martinez, C., Portales, A., Palomar, A., Villegas, M., & Barrios, R. (1993). **Pulmonary arterial hypertension and cor pulmonale associated with chronic domestic woodsmoke inhalation.** *Chest,* 103(l),12-20.

Terblanche, A. P., Opperman, L., Nel, C. M., Reinach, S. G., Tosen, G., & Cadman, A. (1992). **Preliminary results of exposure measurements and health effects of the Vaal Triangle Air Pollution Health Study** . S *Afr Med J 8](11),* 5 5 06.

Viegi, G., Paoletti, P., Carrozzi, L., Vellutini, M., Ballerin, L., Biavati, P., Nardini, G., Di Pede, F., Sapigni, T., Lebowitz,
M. D., & et al. (1991). **Effects of home environment on respiratory symptoms and lung function in a general population sample in north Italy.** *Eur Respir J,* 4(5), 5 80-6.

EPIDEMIOLOGICAL DESIGN

Smith, K, ed. (1992). **Epidemiological, Social and Technical Aspects of Air Pollution from Biomass Fuel** (Report of a WHO Consultation VY'HO/PEP/92.3A). Geneva: World Health Organization.

CASE-CONTROL

Azizi, B. H., Zulkifli, H. I., & Kasim, M. S. (1995). **Protective and risk factors for acute respiratory infections in hospitalized urban Malaysian children: a case control study** . S*outheastAsian J Trop Med Public Health,* 26(2), 280-5.

Collings, D.A., Sithole, S.D.,& Martin, K. S. (1990). **Indoor woodsmoke pollution causing lower respiratory disease in children.** *Trop Doct,* 20(4), 151-5.

Daigler, G. E., Markello, S. J., & Cummings, Y, M. (1991). **The effect of indoor air pollutants on otitis media and asthma in children.** *Laryngoscope,* 10](3), 293-6.

de Francisco, A., Morris, J., Hall, A. J., Armstrong Schellenberg, J. R., & Greenwood, B. M. (1993). **Risk factors for mortality from acute lower respiratory tract infections in young Gambian children Isee comments]** *IntJEpidemiol,* 22(6),1174-82.

Dennis, R. J., Maldonado, D., Norman, S., Baena, E., Castano, H., Martinez, G., &Velez, J. R. (1996). **Wood smoke exposure and risk for obstructive airways disease among women.** *Chest* 109(3 Suppl):55S-56S.

Dennis, R. J., Maldonado, D., Norman, S., Baena, E., & Martinez, G. (1996). **Woodsmoke exposure and risk for obstructive airways disease among women.** *Chest* 109(l):115-9.

Dossing, M., Khan, J., & al-Rabiah, F. (1994). **Risk factors for chronic obstructive lung disease in Saudi Arabia** . R*espir Med* 88(7):519-22.

Fonseca, W., Kirkwood, B. R., Victora, C. G., Fuchs, S. R., Flores, J. A., & Misago, C. (1996). **Risk factors for childhood pneumonia among the urban poor in Fortaleza, Brazil: a case—control study.** Bull *World Health Organ* 74(2):199-208.

Kossove, D. (1982). **Smoke-filled rooms and lower respiratory disease in infants.** S *Afr Med J* 61(17):622-4.

Morris, K., Morgenlander, M., Coulehan, J. L., Gahagen, S., Arena, V. C., & Morganlander, M. (1990). **Wood-burning stoves and lower respiratory tract infection in American Indian children** [published erratum appears in *Am J Dis Child*, 1990 Apr, 144(4):490]. *Am JDis Child* 144(l):105-8.

Mtango, F. D., Neuvians, D., Broome, C. V., Hightower, A. W., & Pio, A. (1992). **Risk factors for deaths in children under 5 years old in Bagamoyo district, Tanzania.** Trop *MedParasitol* 43(4):229-33.

0. Dempsey, T., McArdle, T. F., Morris, J., Lloyd-Evans, N., Baldeh, I., Laurence, B. E., Secka, 0., & Greenwood, B. M. (1996). **A study of risk factors for pneumococcal disease among children in a rural area of west Africa.** *Int J Epidemiol* 25(4):885-93.

Perez-Padilla, R., Regalado, J., Vedal, S., Pare, P., Chapela, R., Sansores, R., & Selman, M. (1996). **Exposure to biomass smoke and chronic airway disease in Mexican women. A case-control study.** *Am J Respir Crit Care Med* 154(3 Pt 1):701-6.

Pershagen,G.,Rylander,E.,Norberg,S.,Eriksson,M.,&Nordvall,S.L.(1995). **Air pollution involving nitrogen dioxide exposure and wheezing bronchitis in children.** *IntJEpidemiol* 24(6):1147-53.

Robin, LF., Less, P. S., Winget, M., Steinhoff, M., Moulton, L. H., Santosham, M., &Correa, A. (1996). **Wood-burning stoves and lower respiratory illnesses in Navajo children.** P*ediatr Infect Dis J* 15(10):859-65.

Shah, N., Ramankutty, V., Premila, P. G., & Sathy, N. (1994). **Risk factors for severe pneumonia in children in south Kerala: a hospital-based case-control study.** *J Trop Pediatr* 40(4):201-6.

Wesley, A. G., & Loening, W. E. (1996). **Assessment and 2-year follow-up of some factors associated with severity of respiratory infections in early childhood.** S *Afr Med J* 86(4):365-8.

Woodward, A., Douglas, R. M., Graham, N.M.,& Miles, H. (1990). **Acute respiratory illness in Adelaide children: breast feeding modifies the effect of passive smoking.** *J Epidemiol Community Health* 44(3):224-30.

CASE STUDIES

Grobbelaar, J. P., & Bateman, E. D. (1991). **Hut lung: a domestically acquired pneumoconiosis of mixed aetiology in rural women [published erratum appears in *Thorax,* 1991 Jul, 46(7):5441.** *Thorax* 46(5):334-40.

Honicky, R_ E., & Osborne, J. S. d. (1991). **Respiratory effects of wood heat: clinical observations and epidemiologic assessment.** *Environ Health Perspect* 95:105-9.

Sandoval, J., Salas, J., Martinez-Guerra, M. L, Gomez, A., Martinez, C., Portales, A., Palomar, A., Villegas, M., & Barrios, R. (1993). **Pulmonary arterial hypertension and cor pulmonale associated with chronic domestic woodsmoke inhalation.** *Chest* 103(l):12-20.

COHORT

Armstrong, J. R., & Campbell, H. (199 1). **Indoor air pollution exposure and lower respiratory infections in young Gambian children.** *In UEpidemiol 2*0(2):424-9.

Awasthi, S., Glick, H. A., Fletcher, F. H., &Ahmed, N. (1996). **Ambient air pollution& respiratory symptoms complex in preschool children.** *Indian JMed Res* 104:257-62.

Honicky,R-E.,Osbome,J.S.d.,&Akpom,C.A.(1985). **Symptoms of respiratory illness in young children and the use of wood-burning stoves for indoor heating.** *Pediatrics* 75(3):587-93.

Samet, J. M., Lambert, W. E., Skipper, B. J., Cushing, A. H., Hunt, W. C., Young, S. A., McLaren, L. C., Schwab, M., & Spengler, J. D. (1993). **Nitrogen dioxide and respiratory illnesses in infants.** *Am Rev Respir Dis* 148(5):1258-65.

Samet, J. M., Lambert, W. E., Skipper, B. J., Cushing, A. H., Hunt, W. C., Young, S. A., McLaren, L. C., Schwab, M., & Spengler, J. D. (1993). **Nitrogen dioxide and respiratory illness in children. Part 1: Health outcomes.** *Res Rep Health EffInst* (58):1-32; discussion 51-80.

Xu, X., Ding, H., & Wang, X. (1995). **Acute effects of total suspended particles and sulfur dioxides on preterm delivery: a community-based cohort study.** *Arch Environ Health* 50(6):407-15.

CROSS-SECTIONAL

Aldous, M. B., Holberg, C. J., Wright, A. L., Martinez, F.D.,& Taussig, L. M. (1996). **Evaporative cooling and other home factors and lower respiratory tract illness during the first year of life.** Group Health Medical Associates. *Am JEpidemiol* 143(5):423-30.

Awasthi, S., Glick, H. A., & Fletcher, R. H. (1996). **Effect of cooking fuels on respiratory diseases in preschool children in Lucknow, India.** *Am J Trop MedHyg* 55(l):48-51.

Azizi, B. H., & Henry, R. L. (1990). **Effects of indoor air pollution on lung function of primary school children in Kuala Lumpur.** *Pediatr Pulmonol* 9(l):24-9.

Azizi, B. H., & Henry, R. L. (1991). **The effects of indoor environmental factors on respiratory illness in primary schoolchildren in Kuala Lumpur.** *Int J Epidemiol. 2*0(l):144-50.

Braun-Fahrlander, C., Ackermann-Liebrich, U., Schwartz, J., Gnehm, H. P., Rutishauser, M., & Wanner, H. U. (1992). **Air pollution and respiratory symptoms in preschool children.** Am *Rev Respir Dis* 145(l):42-7.

Browning, K.G., Koenig, J., Checkoway, H., Larson, T., Pierson, W.E. (1990). **A questionnaire study of respiratory health in areas of high and low ambient wood smoke pollution.** *Pediatric Asthma, Allergy & Immunology* 4(3):183-191.

Cui, J., & MacKay, R. (1993). **Effects of passive smoking on respiratory illness from birth to age eighteen months, in Shanghai, People's Republic of China.** *The Journal ofPediatrics* 123(4):553-8.

Dockery, D. W., Speizer, F. E., Stram, D. 0., Ware, J. H., Spengler, J. D., & Ferris, B. G., Jr. (1989). **Effects of inhalable particles on respiratory health of children.** *Am Rev Respir Dis* 139(3):587-94.

Dodge, R. (1982). **The effects of indoor pollution on Arizona children.** *Arch Environ Health* 37(3):151-5.

Ellegard, A. (1996). **Cooking fuel smoke and respiratory symptoms among women in low-income areas in Maputo.** *Environ Health Perspect* 104(9):980-5.

Femi-Pearse, D., Adeniyi-Jones, A., & Oke, A. (1973). **Respiratory symptoms and their relationship to cigarette-smoking, dusty occupations and domestic air pollution: studies in random sample of an urban African population.** *West Afr MedJNiger Med Dent Pract* 22(3):57-63.

Ferris, B. G., Jr., Dockery, D. W., Ware, J. H., Speizer, F. E., & Spiro, R.D. (1983). **The Six-City Study: examples of problems in analysis of the data.** *Environ Health Perspect* 52:115-23.

Gharaibeh, N. S. (1996). **Effects of indoor air pollution on lung function of primary school children in Jordan.** *Ann Trop Paediatr* 16(2):97-102.

Goren, A. L, & Hellmann, S. (1995). **Respiratory conditions among schoolchildren and their relationship to environmental tobacco smoke and other combustion products.** *Arch Environ Health* 50(2):112-8.

Guneser, S., Atici, A., Alparslan, N., & Cinaz, P. (1994). **Effects of indoor environmental factors on respiratory systems of children.** *J Trop Pediatr* 40(2):114-6.

Johnson, A. W., & Aderele, W. I. (1992). **The association of household pollutants and socio-economic risk factors with the short-term outcome of acute lower respiratory infections in hospitalized pre-school Nigerian children.** *Ann Trop Paediatr* 12(4):421-32.

Menezes, A. M., Victora, C. G., & Rigatto, M. (1994). **Prevalence and risk factors for chronic bronchitis in Pelotas, RS, Brazil: a population-based study.** *Thorax* 49(12):1217-2 1.

Murtagh, P., Cerqueiro, C., Halac, A., Avila, M., Salomon, H., & Weissenbacher, M. (1993). **Acute lower respiratory infection in Argentinian children: a 40 month clinical and epidemiological study.** P*ediatr Pulmonol* 16(l):1-8.

Ogston, S.A., Florey, C.D., & Walker, C.H. (1987). **Association of infant alimentary and respiratory illness with parental smoking and other environmental factors.** *JEpidemiol Community Health* 41(1):21-5.

Ostro, B. D., & Rothschild, S. (1989). **Air pollution and acute respiratory morbidity: an observational study of multiple pollutants.** *Environ Res* 50(2):238-47.

Pandey, M., Basnyat, B., & Neupane, R. (1988). **Chronic Bronchitis and Cor Pulmonale in Nepal.** (First ed.). Kathmandu, Nepal: Mrigendra Medical Trust.

Stem, B.R., Raizenne, M.E., Burnett, R. T., Jones, L, Kearney, J., &Franklin, C. A. (1994). **Air pollution and childhood respiratory health: exposure to sulfate and ozone in 10 Canadian rural communities.** *Environ Res* 66(2):125-42.

Tumwesigire, S. G., & Barton, T. (1995). Environmental risk factors for acute respiratory infections among children of military personnel in Uganda. *East Afr Med J* 72(5):290-4.

Tuthill, R. W. (1984). Woodstoves, formaldehyde, and respiratory disease. *Am JEpidemiol* 120(6):952-5.

Verma, B.K., & Thakur, D.K. (l995). **Effect of stressful environmental factors upon neonatal immune system.** *Cent Eur J Public Health* 3(l):25-9.

Viegi, G., Carrozzi, L., Paoletti, P., Vellutini, M., DiViggiano, E., Baldacci, S., Modena, P., Pedreschi, M., Mammini, U., di Pede, C., & et al. (1992). **Effects of the home environment on respiratory symptoms of a general population sample in middle Italy.** *Arch Environ Health* 47(l):64-70.

Volkmer, R. E., Ruffin, R. E., Wigg, N. R., & Davies, N. (1995). The prevalence of respiratory symptoms in South Australian preschool children. H. Factors associated with indoor air quality. *J Paediatr Child Health* 31(2):116-20.

Waftila, E. M., Onyango, F. E., Thairu, H., Boleij, J. S., Hoek, F., Ruigewaard, P., Kagwanja, S., De Koning, H., Pio, A., Kimani, E., & et al. (1990). **Indoor air pollution in a Kenyan village.** *East Afr MedJ* 67(l):24-32.

Wang, X., Ding, H., Ryan, L., & Xu, X. (1997). **Association between air pollution and low birth weight: a community-based study.** *Environmental Health Perspectives* 105 (5):514-520.

Zwi, S., Davies, J. C., Becklake, M. R., Goldman, H. I., Reinach, S. G., & Kallenbach, J. M. (1990). **Respiratory health status of children in the eastern Transvaal highveld.** *SA/rMedJ* 78(11):647-53.

ECOLOGICAL

Albalak, R. (1997). **Cultural practices and exposure to particulate pollution from indoor biomass cooking: Effects on respiratory health and nutritional status antong the Aymara Indians of the Bolivian Highlands.** Unpublished Doctoral Dissertation, University of Michigan.

Awasthi, S., Glick, H.A., Fletcher, R. H., & Ahmed, N. *(1996).* **Ambient air pollution& respiratory symptoms complex in preschool children.** *Indian JMed Res* 104:257-62.

Bladen, W. A. (1983). **Relationship between acute respiratory illness and air pollution in an India industrial city.** *Journal of the Air Pollution Control Association* 33(3):226-7.

Dimitriev, D.A. (1994). **[Effect of air pollution on respiration in children.]** *Gig Sanit* 7:7-9.

Ferris, B.G., Jr., Dockery, D. W., Ware, J. H., Speizer, F. E., & Spiro, R.D (1983). **The Six-City Study: examples of problems in analysis of the data.** *Environ Health Perspect* 52:115-23.

Goren, A. I., Hellman, S., Brenner, S., Egoz, N., & Rishpon, S. (1990). **Prevalence of respiratory conditions among schoolchildren exposed to different levels of air pollutants in the Haifa Bay area, Israel.** *Environ Health Perspect* 89:225-31.

He, Q.C.,Uoy, P.J., Wilson, W.E., & Chapman, R.S. (1993). **Effects of air pollution on children's pulmonary function in urban and suburban areas of Wuhan, People's Republic of China.** *Arch Environ Health* 48(6):382-91.

Jedrychowski, W., Flak, E., & Mroz, E. (1995). **[Prospective epidemiologic study on respiratory diseases in children in Cracow. Pilot study].** *Przegl Epidemiol* 49(3):331-9.

Jedrychowski, W., Flak, E., & Mroz, E. (1996). **[Variability of respiratory system reactions to air pollutants. Epidemiologic study of children in Cracow.]** *Pneumonol Alergol Pol* 64(5-6):267-75.

Lunn, J.E., Knowelden, J., & Handyside, A.J. (1967). **Patterns of respiratory illness in Sheffield infant schoolchildren.** *Br J Prev Soc Med* 21(1):7-16.

Mazur, B. (1995). **Peak expiratory flow values in children relative to the degree of atmospheric air pollution.** *Acta Paediatr* 84(2):203-5.

Penna, M.L., & Duchiade, M.P. (1991). **[Air pollution and infant mortality from pneumonia].** *Bol Oficina Sanit Panam* 110(3):199-207.

Perma, M.L., & Duchiade, M.P. (1991). **Air pollution and infant mortality from pneumonia in the Rio de Janeiro metropolitan area.** *Bull Pan Am Health Organ* 25(1):47-54.

Sobral, H.R. (1989). **Air pollution and respiratory diseases in children in Sao Paulo, Brazil.** *Soc Sci Med* 29(8):959-64.

Tatotschenko, W.K, & Nesterenko, S.W. (1990). **[Effect of moderate pollutant concentrations in the air and incidence of respiratory diseases in children].** *Z Erkr Atmungsorgane* 174(3):185-9.

Woodruff, T.J., Grillo, J., & Schoendorf, K.G. (1997). **The relationship between selected causes of postneonatal infant mortality and particulate air pollution in the United States.** *Environmental Health Perspectives* 105(6):608-612.

INTERVENTION

No studies currently available.

LONGITUDINAL

Anderson, H.R. (1978). **Respiratory abnormalities in Papua New Guinea children: the effects of locality and domestic wood smoke pollution.** *Int J Epidemiol* 7(l):63-72.

Bates, D. V. (1995). **The effects of air pollution on children.** *Environ Health Perspect* 103 Suppl 6:49-53.

Dodge, R. (1982). **The effects of indoor pollution on Arizona children.** *Arch Environ Health* 37(3):151-5.

Helfenstein,U., Ackermann-Liebrich, U., Braun-Fahrlander, C., & Wanner, H.U. (1991). **The environmental accident at 'Schweizerhalle' and respiratory diseases in children: a time series analysis.** *Stat Med* 10(l0):1481-92.

Herbarth, 0. (1995). **Risk assessment of environmentally influenced airway diseases based on time-series analysis.** *Environ Health Perspect* 103(9):852-6.

Hoek, G., & Brunekreet B. (1995). **Effect of photochemical air pollution on acute respiratory symptoms in children.** *Am JRespir Crit Care Med* 151(l):27-32.

Mm, P.E., Musher, D.M., Glezen, W.P., Rodriguez-Barradas, M.C., Nahm, W.K., & Wright, C.E. (1996). **Association of invasive pneumococcal disease with season, atmospheric conditions, air pollution, and the isolation of respiratory viruses.** *Clin Infect Dis* 22(l), 100-6.

Koenig, J.Q., Larson, T.V., Hanley, Q.S., Rebolledo, V., Durnler, K., Checkoway, H., Wang, S.Z., Lin, D., & Pierson, W.E. (1993). **Pulmonary function changes in children associated with fine particulate matter.** *Environ Res* 63(l):26-38.

Neas, L.M., Dockery, D.W., Koutrakis, P., Tollerud, D.J., & Speizer, F.E. (1995). **The association of ambient air pollution with twice daily peak expiratory flow rate measurements in children.** *Am J Epidemiol* 141(2):111-22.

Ostro, B. (1993). **The association of air pollution and mortality: examining the case for inference.** *Arch Environ Health* 48(5):336-42.

Ponka, A. (1990). **Absenteeism and respiratory disease among children and adults in Helsinki in relation to low-level air pollution and temperature.** *Environ Res* 52(1):34-46.

Pope, C.A.D. (1989). **Respiratory disease associated with community air pollution and a steel mill, Utah Valley.** *Am JPublic Health* 79(5):623-8.

Pope, C.A.D., & Dockery, D. W. (1992). **Acute health effects of PM10 pollution on symptomatic and asymptomatic children.** *Am Rev Respir Dis* 145(5):1123-8.

Pope, C.A., 3rd. (1996). Particulate pollution and health: a review of the Utah valley experience. *J Expo Anal Environ Epidemiol* 6(l):23-34.

Ransom, M.R., & Pope, C.A.D. (1992). **Elementary school absences and PM10 pollution in Utah Valley.** E*nviron Res* 58(2):204-19.

Roemer, W., Hoek, G., & Brunekreef, B. (1993). **Effect of ambient winter air pollution on respiratory health of children with chronic respiratory symptoms.** *Am Rev Respir Dis* 147(l):118-24.

Saldiva, P.H., Lichtenfels, A.J., Paiva, P.S., Barone, I.A., Martins, M.A., Massad, E., Pereira, J.C., Xavier, V.P., Singer, J.M., & Bohm, G.M. (1994). **Association between air pollution and mortality due to respiratory diseases in children in Sao Paulo, Brazil: A preliminary report.** *Environ Res* 65(2):218-25.

Samet, J.M., & Spengler, J.D. (1989). **Nitrogen dioxide and respiratory infection: pilot investigations.** *Res Rep Health Eff Inst* (28):1-32.

Schwartz, J., Dockery, D.W., Neas, L.M., Wypij, D., Ware, J.H., Spengler, J.D., Koutrakis, P., Speizer, F.E., & Ferris, B.G., Jr. (1994). **Acute effects of summer air pollution on respiratory symptom reporting in children.** *Am JRespir Crit Care Med* 150(5 Pt 1):1234-42.

Schwartz, J. (1994). **What are people dying of on high air pollution days?** *Environ Res* 64(l):26-35.

Terblanche, A.P., Opperman, L., Nei, C.M., Reinach, S.G., Tosen, G., & Cadman, A. (1992). **Preliminary results of exposure measurements and health effects of the Vaal Triangle Air Pollution Health Study.** *SAfir MedJ,* 81(11):55-6.

ESTABLISHED MARKET ECONOMIES

WESTERN EUROPE

Boleij, J. S., & Brunekreef, B. (1989). **Domestic pollution as a factor causing respiratory health effects.** *Chest* 96 (3 Suppl):368S-372S.

Braun-Fahrlander, C., Ackermann-Uebrich, U., Schwartz, J., Gnehm, H.P., Rutishauser, M., & Wanner, H.U. (1992). **Air pollution and respiratory symptoms in preschool children.** *Am Rev Respir Dis* 145(l):42-7.

Garcia-Marcos, L, Guillen Perez, J.J.,Niguez, J.C., & Guillen Marco, A. (1993). **[Air pollution and respiratory disease in children. Experience in Cartagena].** An Esp *Pediatr,* 39 Suppl 55:83-5. [Spanish]

Helfenstein,U., Ackerrnann-Liebrich, U., Braun-Fahrlander, C., & Wanner, H.U. (1991). **The environmental accident at 'Schweizerhalle' and respiratory diseases in children: a time series analysis.** *Stat Med* 10(l0):1481-92.

Hoek, G., & Brunekreef, B. (1995). **Effect of photochemical air pollution on acute respiratory symptoms in children.** *Am JRespir Crit Care Med* 151(1):27-32.

Lercher, P., Schmitzberger, R., & Kofler, W. (1995). **Perceived traffic air pollution, associated behavior and health in an alpine area.** *Sci Total Environ* 169(1-3):71-4.

Lunn, J.E., Knowelden, J., & Handyside, A.J. (1967). Patterns of respiratory illness in Sheffield infant schoolchildren. *Br J Prev Soc Med* 21(1):7-16.

Pershagen, G., Rylander, E., Norberg, S., Eriksson, M., & Nordvall, S.L. (1995). **Air pollution involving nitrogen dioxide exposure and wheezing bronchitis in children.** *Int J Epidemiol* 24(6):1147-53.

Roemer, W., Hoek, G., & Brunekreef, B. (1993). **Effect of ambient winter air pollution on respiratory health of children with chronic respiratory symptoms.** *Am Rev Respir Dis* 147(l):118-24.

Viegi, G., Paoletti, P., Carrozzi, L., Vellutini, M., Ballerin, L., Biavati, P., Nardini, G., Di Pede, F., Sapigni, T., Lebowitz, M. D., & et al. (1991). **Effects of home environment on respiratory symptoms and lung function in a general population sample in north Italy.** *Eur Respir J* 4(5):580-6.

Viegi, G., Carrozzi, L., Paoletti, P., Vellutini, M., DiViggiano, E., Baldacci, S., Modena, P., Pedreschi, M., Mammini, U., di Pede, C., & et al. (1992). **Effects of the home environment on respiratory symptoms of a general population sample in middle Italy.** *Arch Environ Health* 47(l):64-70.

Wichmann, H.E., & Heinrich, J. (1995). **Health effects of high level exposure to traditional pollutants in East Germany—review and ongoing research.** *Environ Health Perspect,* 103 Suppl 2:29-35.

NORTH AMERICA

(1993). **American Academy of Pediatrics Committee on Environmental Health: Ambient air pollution: respiratory hazards to children.** *Pediatrics* 91(6):1210-3.

Aldous, M.B., Holberg, C.J., Wright, A.L., Martinez, F.D., & Taussig, L.M. (1996). **Evaporative cooling and other home factors and lower respiratory tract illness during the first year of life.** Group Health Medical Associates. *Am J Epidemiol* 143(5):423-30.

Browning, K.G., Koenig, J., Checkoway, H., Larson, T., Pierson, W.E. (1990). **A questionnaire study of respiratory health in areas of high and low ambient wood smoke pollution.** *Pediatric Asthma, Allergy & Immunology* 4(3):183-191.

Dockery, D.W., Ware, J.H., Ferris, B.G., Jr., Speizer, F.E., Cook, N.R., & Herman, S.M. (1982). **Change in pulmonary function in children associated with air pollution episodes.** *J Air Pollut Control Assoc* 32 (9):937-42.

Dockery, D.W., Speizer, F.E., Stram, D.O., Ware, J.H., Spengler, J.D., & Ferris, B.G., Jr. (1989). **Effects of inhalable particles on respiratory health of children.** *Am Rev Respir Dis* 139(3):587-94.

Dockery, D.W., & Schwartz, J. (1995). **Particulate air pollution and mortality: more than the Philadelphia story [comment].** *Epidemiology* 6(6):629-32.

Dockery, D.W., & Brunekreef, B. (1996). **Longitudinal studies of air pollution effects on lung function.** *Am J Respir Crit Care Med* 154 (6 Pt 2):S250-6.

Dockery, D.W., Cunningham, J., Damokosh, A.I., Neas, L.M., Spengler, J.D., Koutrakis, P., Ware, J.H., Raizenne, M., & Speizer, F.E. (1996). **Health effects of acid aerosols on North American children: respiratory symptoms.** *Environ Health Perspect* 104(5):500-5.

Dodge, R. (1982). **The effects of indoor pollution on Arizona children.** *Arch Environ Health* 37(3):151-5.

Heumann, M., Foster, L., Johnson, L., & Kelly, W. (1991). **Woodsmoke air pollution and changes in pulmonary function among elementary school children.** Portland: Oregon Health Division, Office of Epidemiology.

Honicky, R.E., & Osborne, J.S.D. (1991). **Respiratory effects of wood beat: clinical observations and epiderniologic assessment.** *Environ Health Perspect* 95:105-9.

Kini, P.E., Musher, D.M., Glezen, W.P., Rodriguez-Barradas, M.C., Nalun, W.K., & Wright, C.E. (1996). **Association of invasive pneumococcal disease with season, atmospheric conditions, air pollution, and the isolation of respiratory viruses.** *Clin Infect Dis* 22(l):100-6.

Koenig, J.Q., Larson, T.V., Hanley, Q.S., Rebolledo, V., Dumler, K., Checkoway, H., Wang, S.Z., Lin, D., & Pierson, W.E. (1993). **Pulmonary function changes in children associated with fine particulate matter.** *Environ Res* 63(l):26-38.

Morris, K., Morgenlander, M., Coulehan, J.L., Gahagen, S., Arena, V.C., & Morganlander, M. (1990). **Wood-burning stoves and lower respiratory tract infection in American Indian children [published erratum. appears in Am J Dis Child 1990 Apr;144(4):4901.** *Am J Dis Child* 144(l):105-8.

Neas, L.M., Dockery, D.W., Koutrakis, P., Tollerud, D.J., & Speizer, F.E. (1995). **The association of ambient air pollution with twice daily peak expiratory flow rate measurements in children.** *Am J Epidemiol* 141(2):111-22.

Neas, L.M., Dockery, D.W., Burge, H., Koutrakis, P., & Speizer, F.E. (1996). **Fungus spores, air pollutants, and other determinants of peak expiratory flow rate in children.** *Am J Epidemiol* 143(8):797-807.

Osborne, J., & Honicky, R. (1990). **Health effects of heating with woodburning stoves: a prospective study of chronic symptoms of respiratory disease in young children.** Paper presented at the Proceedings of the 5th International Conference on Indoor Air Quality and Climate, July 29- August 3, Toronto, Canada.

Ostro, B.D. (1989). **Estimating the risks of smoking, air pollution, and passive smoke on acute respiratory conditions.** *Risk Anal* 9(2):189-96.

Ostro, B.D., & Rothschild, S. (1989). **Air pollution and acute respiratory morbidity: an observational study of multiple pollutants.** *Environ Res* 50(2):238-47.

Ostro, B. (1993). **The association of air pollution and mortality: examining the case for inference.** *Arch Environ Health* 48(5):336-42.

Pope, C.A.D. (1989). **Respiratory disease associated with community air pollution and a steel mill, Utah Valley.** *Am J Public Health* 79(5):623-8.

Pope, C.A.d., Dockery, D.W., Spengler, J.D., & Raizenne, M.E. (1991). **Respiratory health and PM10 pollution. A daily time series analysis.** *Am Rev Respir Dis* 144(3 Pt 1):668-74.

Pope, C.A.d., & Dockery, D.W. (1992). **Acute health effects of PM10 pollution on symptomatic and asymptomatic children.** *Am Rev Respir Dis* 145(5):1123-8.

Pope, C.A., 3rd, Bates, D.V., & Raizenne, M.E. (1995). **Health effects of particulate air pollution: time for reassessment?** *Environ Health Perspect* 103(5):472-80.

Pope, C.A., 3rd. (1996). **Adverse health effects of air pollutants in a nonsmoking population.** *Toxicology* 111(1-3):149-55.

Pope, C. A., 3rd. (1996). **Particulate pollution and health: a review of the Utah valley experience.** *J Expo Anal Environ Epidentiol* 6(l):23-34.

Raizenne, M., Neas, L. M., Damokosh, A. L, Dockery, D. W., Spengler, J. D., Koutrakis, P., Ware, J. H., & Speizer, F. E. (1996). **Health effects of acid aerosols on North American children: pulmonary function.** *Environ Health Perspect* 104(5):506-14.

Raizenne, M., Neas, L.M., Damokosh, A.I., Dockery, D.W., Spengler, J.D., Koutrakis, P., Ware, J.H., & Speizer, F.E. (1996). **Health effects of acid aerosols on North American children: pulmonary function.** *Environ Health Perspect* 104(5):506-14.

Ransom, M.R., & Pope, C.A.d. (1992). **Elementary school absences and PM10 pollution in Utah Valley.** *Environ Res* 58(2):204-19.

Robin, LF., Less, P.S., Winget, M., Steinhoff, M., Moulton, L.H., Santosham, M., & Correa, A. (1996). **Wood-burning stoves and lower respiratory illnesses in Navajo children.** Pediatr Infect Dis J 15(10):859-65.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1987). **Health effects and sources of indoor air pollution. Part 1.** *Am Rev Respir Dis* 136(6):1486-508.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1987). **Respiratory effects of indoor air pollution.** *J Allergy Clin Immunol* 79(5):685-700.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1988). **Health effects and sources of indoor air pollution. Part H.** *Am Rev Respir Dis* 137(l):221-42.

Samet, J.M., & Spengler, J.D. (1989). **Nitrogen dioxide and respiratory infection: pilot investigations.** *Res Rep Health Eff Inst* (28):1-32.

Samet, J.M., Lambert, W.E., Skipper, B.J., Cushing, A.H., Hunt, W.C., Young, S.A., McLaren, L.C., Schwab, M., & Spengler, J.D. (1993). **Nitrogen dioxide and respiratory illnesses in infants.** *Am Rev Respir Dis* 148(5):125 8-65.

Sarnet, J.M., & Speizer, F.E. (1993). **Assessment of health effects in epiderniologic studies of air pollution.** *Environ Health Perspect* 101 Suppl 4:149-54.

Samet, J.M., Lambert, W.E., Skipper, B.J., Cushing, A.H., Hunt, W.C., Young, S.A., McLaren, L.C., Schwab, M., & Spengler, J.D. (1993). **Nitrogen dioxide and respiratory illness in children. Part 1: Health outcomes.** *Res Rep Health Eff Inst* (58):1-32; discussion 51-80.

Schwartz, J., Dockery, D.W., Neas, L.M., Wypij, D., Ware, J.H., Spengler, J.D., Koutrakis, P., Speizer, F.E., & Ferris, B.G., Jr. (1994). **Acute effects of summer air pollution on respiratory symptom reporting in children.** *Am J Respir Crit Care Med* 150(5 Pt 1):1234-42.

Schwartz, J. (1994). **What are people dying of on high air pollution days?** *Environ Res* 64(l):26-35.

Stem, B.R., Raizenne, M.E., Burnett, R.T., Jones, L, Kearney, J., & Franklin, C.A. (1994). **Air pollution and childhood respiratory health: exposure to sulfate and ozone in 10 Canadian rural communities.** *Environ Res* 66(2):125-42.

Tuthill, R.W. (1984). **Woodstoves, formaldehyde, and respiratory disease.** *Am J Epidemiol* 120(6):952-5.

Woodruff, T.J., Grillo, J., & Schoendorf, K.G. (1997). **The relationship between selected causes of postneonatal infant mortality and particulate air pollution in the United States.** *Environmental Health Perspectives* 105(6):608-612.

FORMER SOVIET UNION/EASTERN EURO

Dimitriev, D.A. (1994). **[Effect of air pollution on respiration in children].** *Gig Sanit* (7):7-9.

Jedrychowski, W. (1995). **Review of recent studies from central and Eastern Europe associating respiratory health effects with high levels of exposure to "traditional" air pollutants.** *Environ Health Perspect* 103 Suppl 2:15-21.

Jedrychowski, W., Flak, E., & Mroz, E. (1995). **[Prospective epiderniologic study on respiratory diseases in children in Cracow. Pilot study].** *Przegl Epidemiol* 49(3):331-9.

Jedrychowski, W., Flak, E., & Mroz, E. (1996). **[Variability of respiratory system reactions to air pollutants Epidemiologic study of children in Cracow].** *Pneumonol Alergol Pol* 64(5-6):267-75.

Mazur, B. (1995). **Peak expiratory flow values in children relative to the degree of atmospheric air pollution.** *Acta Paediatr* 84(2):203-5.

Sram, R.J., Benes, I., Binkova, B., Dejmek, J., Horstman, D., Kotesovec, F., Ono, D., Perreault, S.D., Rubes, J., Selevan, S.G., Skalik, I., Stevens, R.K., & Lewtas, J. (1996). **Teplice program—the impact of air pollution on human health.** *Environ Health Perspect* 104 Suppl 4:699-714.

Tatotschenko, W.K, & Nesterenko, S.W. (1990). **[Effect of moderate pollutant concentrations in the air and incidence of respiratory diseases in children].** *Z Erkr Atmungsorgane* 174(3):185-9.

INDIA

Awasthi, S., Glick, H.A., Fletcher, R.H., & Ahmed, N. (1996). **Ambient air pollution & respiratory symptoms complex in preschool children.** *Indian J Med Res* 104:257-62.

Awasthi, S., Glick, H.A., & Fletcher, R.H. (1996). **Effect of cooking fuels on respiratory diseases in preschool children in Lucknow, India.** *Am J Trop Med Hyg* 55(l):48-5 1.

Behera, D., & Jindal, S.K. (1991). **Respiratory symptoms in Indian women using domestic cooking fuels.** *Chest* 100(2):385-8.

Bladen, W.A. (1983). **Relationship between acute respiratory illness and air pollution in an India industrial city.** *Journal of the Air Pollution Control Association* 33(3):226-7.

Dhar, S., & Pathania, A. (1991). **Bronchitis due to biomass fuel burning in North India: "Guijjar Lung," an extreme effect.** *Seminars in Respiratory Medicine* 12(2):69-74.

Guha-Sapir, D. (1996). **Environment of urban poor communities in Asia: study on the effects of indoor air pollution among infants in DeN and Manila** (Final Report (draft)). Brussels: Catholic University of Louvain, Department of Public Health.

Malk S.K. (1985). **Exposure to domestic cooking fuels and chronic bronchitis.** *Indian J Chest Dis Allied Sci* 27(3):171-4.

Malik, S.K. (1985). **Cooking fuels and chronic respiratory disease [letter].** *J Assoc Physicians India* 33(5):378.

Mavalankar, D.V., Trivedi, C.R., & Grah, R.H. (1991). **Levels and risk factors for perinatal mortality in Ahmedabad, India.** *Bulletin of WHO* 69(4):435-442.

Mishra, S., & Chaturvedi, P. (1995). **Acute respiratory infections with special reference to pneumonia in underfives.** *J Indian Med Assoc* 93(9):351-5.

Narain, J.P. (1987). **Epidemiology of acute respiratory infections.** *Indian J Pediatr* 54(2):153-60.

Norboo, T., Yahya, M., Bruce, N.G., Heady, J.A., & Ball, K.P. (1991). **Domestic pollution and respiratory illness in a Himalayan village.** *Int J Epidemiol* 20(3):749-57.

Sehgal, S. (1993). **Pneumocystis pneumonia: a time to shed complacence [editorial; comment].** *J Assoc Physicians India* 41(1):5-7.

Shah, N., Ramankutty, V., Premila, P.G., & Sathy, N. (1994). **Risk factors for severe pneumonia in children in south Kerala: a hospital-based case-control study.** *J Trop Pediatr* 40(4):201-6.

Smith, K. R. (1996). **Indoor air pollution in India [editorial].** *Natl Med J India* 9(3):103-4.

Verma, B.K, & Thakur, D.K (1995). **Effect of stressful environmental factors upon neonatal immune system.** *Cent Eur J Public Health* 3(1):25-9.

INDOOR AIR POLLUTION SOURCES

COAL

Awasthi, S., Glick, H.A., Fletcher, R.H., & Ahmed, N. (1996). **Ambient air pollution & respiratory symptoms complex in preschool children.** *Indian J Med Res* 104:257-62.

Bates, D.V. (1995). **The effects of air pollution on children.** *Environ Health Perspect* 103 Suppl 6:49-53.

Chen, B.H., Hong, C.J., Pandey, M.R., & Smith, K.R. (1990). **Indoor air pollution in developing countries.** *World Health Stat Q* 43(3):127-38.

Cui, J., & MacKay, R. (1993). **Effects of passive smoking on respiratory illness from birth to age eighteen months, in Shanghai, People's Republic of China.** *The Journal of Pediatrics* 123(4):553-8.

Ellegard, A. (1996). **Cooking fuel smoke and respiratory symptoms among women in low-income areas in Maputo.** *Environ Health Perspect* 104(9):980-5.

Florig, H. (1997). **China's air pollution risks.** *Environmental Science & Technology* 31(6):274A-279A.

He, Q.C., Lioy, P.J., Wilson, W.E., & Chapman, R.S. (1993). **Effects of air pollution on children's pulmonary function in urban and suburban areas of Wuhan, People's Republic of China.** *Arch Environ Health* 48(6):382-91.

Hong, C. (1991). **Health aspects of domestic use of biomass and coal in China.** Geneva: WHO.

Malik, S.K. (1985). **Cooking fuels and chronic respiratory disease [letter].** *J Assoc Physicians India* 33(5):378.

Moriske, H.J., Drews, M., Ebert, G., Menk, G., Scheller, C., Schondube, M., & Konieczny, L. (1996). **Indoor air pollution by different heating systems: coal burning, open fireplace and central heating.** *Toxicol Lett* 88(1-3):349-54.

Sram, R.J., Benes, I., Binkova, B., Dejmek, J., Horstman, D., Kotesovec, F., Otto, D., Perreault, S.D., Rubes, J., Selevan, S.G., Skalik, I., Stevens, R.K., & Lewtas, J. (1996). **Teplice program—the impact of air pollution on human health.** *Environ Health Perspect* 104 Suppl 4:699-714.

Wang, X., Ding, H., Ryan, L., & Xu, X. (1997). **Association between air pollution and low birth weight: a community-based study.** *Environmental Health Perspectives* 105(5):514-520.

Wesley, A.G., & Loening, W.E. (1996). **Assessment and 2-year follow-up of some factors associated with severity of respiratory infections in early childhood.** *S Afr Med J* 86(4):365-8.

INCENSE/MOSQUITO COILS

Azizi, B.H., & Henry, R.L. (1990). **Effects of indoor air pollution on lung function of primary school children in Kuala Lumpur.** *Pediatr Pulmonol* 9(1):24-9.

Azizi, B. H., & Henry, R. L. (1991). **The effects of indoor environmental factors on respiratory illness in primary school children in Kuala Lumpur.** *Int J Epidemiol* 20(1):144-50.

Dossing, M., Khan, J., & al-Rabiah, F. (1994). **Risk factors for chronic obstructive lung disease in Saudi Arabia.** *Respir Med* 88(7):519-22.

WOOD

Anderson, H.R. (1978). **Respiratory abnormalities in Papua New Guinea children: the effects of locality and domestic wood smoke pollution.** *Int J Epidemiol* 7(1):63-72.

Anderson, H.R. (1979). **Chronic lung disease in the Papua New Guinea Highlands.** *Thorax* 34(5):647-53.

Anderson, H.R. (1979). **Respiratory abnormalities, smoking habits and ventilatory capacity in a highland community in Papua New Guinea: prevalence and effect on mortality.** *Int J Epidemiol* 8(2):127-35.

Awasthi, S., Glick~ H. A., Fletcher, R. H., & Ahmed, N. (1996). **Ambient air pollution & respiratory symptoms complex in preschool children.** *Indian J Med Res* 104:257-62.

Azizi, B.H., & Henry, R.L. (1990). **Effects of indoor air pollution on lung function of primary school children in Kuala Lumpur.** *Pediatr Pulmonol* 9(1):24-9.

Azizi, B.H., & Henry, R.L. (1991). **The effects of indoor environmental factors on respiratory illness in primary school children in Kuala Lumpur.** *Int J Epidemiol* 20(1):144-50.

Boleij, J.S., & Brunekreef, B. (1989). **Domestic pollution as a factor causing respiratory health effects.** *Chest* 96(3 Suppl):368S-372S.

Browning, K.G., Koenig, J., Checkoway, H., Larson, T., Pierson, W.E. (1990). **A questionnaire study of respiratory health in areas of high and low ambient wood smoke pollution.** *Pediatric Asthma, Allergy & Immunology* 4(3):183-191.

Butterfield, P., Edinundson, E., LaCava, G., & Penner, J. (1989). **Woodstoves and indoor air: the effects on preschooler's upper respiratory systems.** *Journal of Environmental Health*, 52(3):172-3.

CoIlings, D.A., Sithole, S.D., & Martin, K.S. (1990). **Indoor woodsmoke pollution causing lower respiratory disease inchildren.** *Trop Doct* 20(4):151-5.

Daigler, G.E., Markello, S.J., & Cummings, K.M. (1991). **The effect of indoor air pollutants on otitis media and asthma in children.** *Laryngoscope* 101(3):293-6.

Dennis, R. J., Maldonado, D., Norman, S., Baena, E., Castano, H., Martinez, G., & Velez, J. R. (1996). **Wood smoke exposure and risk for obstructive airways disease among women.** *Chest* 109(3 Suppl):55S-56S.

Dennis, R. J., Maldonado, D., Norman, S., Baena, E., & Martinez, G. (1996). **Woodsmoke exposure and risk for obstructive airways disease among women.** *Chest* 109(1):115-9.

Dossing, M., Khan, J., & al-Rabiah, F. (1994). **Risk factors for chronic obstructive lung disease in Saudi Arabia.** *Respir Med* 88(7):519-22.

Ellegard, A. (1996). **Cooking fuel smoke and respiratory symptoms among women in low-income areas in Maputo.** *Environ Health Perspect* 104(9):980-5.

Femi-Pearse, D., Adeniyi-Jones, A., & Oke, a. (1973). **Respiratory symptoms and their relationship to cigarettesmoking, dusty occupations and domestic air pollution: studies in random sample of an urban African population.** *West Afr Med J Niger Med Dent Pract* 22(3):57-63.

Gharaibeh, N.S. (1996). **Effects of indoor air pollution on lung function of primary school children in Jordan.** *Ann Trop Paediatr* 16(2):97-102.

Guneser, S., Atici, A., Alparslan, N., & Cinaz, P. (1994). **Effects of indoor environmental factors on respiratory systems of children.** *J Trop Pediatr* 40(2):114-6.

Heumann, M., Foster, L., Johnson, L., & Kelly, W. (1991). **Woodsmoke air pollution and changes in pulmonary function among elementary school children.** Portland: Oregon Health Division, Office of Epidemiology.

Honicky, R. E., Akpom, C. A., & Osborne, J. S. (1983). **Infant respiratory illness and indoor air pollution from a woodburning stove.** *Pediatrics* 71(1):126-8.

Honicky, R. E., Osborne, J. S. d., & Akpom, C. A. (1985). **Symptoms of respiratory illness in young children and the use of wood-burning stoves for indoor heating.** *Pediatrics* 75(3):587-93.

Honicky, R.E., & Osborne, J.S.d. (1991). **Respiratory effects of wood heat: clinical observations and epiderniologic assessment.** *Environ Health Perspect* 95:105-9.

Johnson, A.W., & Aderele, W.I. (1992). **The association of household pollutants and socio-economic risk factors with the short-term outcome of acute lower respiratory infections in hospitalized pre-school Nigerian children.** *Ann Trop Paediatr* 12(4):421-32.

Koenig, J.Q. (1988). **Indoor and outdoor pollutants and the upper respiratory tract.** *J Allergy Clin Immunol* 81(5 Pt 2):1055-9.

Koenig, J.Q., Larson, T.V., Hanley, Q.S., Rebolledo, V., Dumler, K., Checkoway, H., Wang, S.Z., Lin, D., & Pierson, W.E. (1993). **Pulmonary function changes in children associated with fine particulate matter.** *Environ Res* 63(1):26-38.

Kossove, D. (1982). **Smoke-filled rooms and lower respiratory disease in infants.** *S Afr Med J* 61(17):622-4.

Larson, T.V., & Koenig, J.Q. (1994). **Wood smoke: emissions and noncancer respiratory effects.** *Annu Rev Public Health* 15:133-56.

Malik, S.K. (1985). **Cooking fuels and chronic respiratory disease [letter].** *J Assoc Physicians India* 33(5):378.

Marbury, M. (1991). **Wood smoke.** In J. Samet & J. Spengler (Eds.), *Indoor Air Pollution: A Health Perspective* (pp. 209222). Baltimore and London: The Johns Hopkins University Press.

Moriske, H.J., Drews, M., Ebert, G., Menk, G., Scheller, C., Schondube, M., & Konieczny, L. (1996). **Indoor air pollution by different heating systems: coal burning, open fireplace and central heating.** *Toxicol Lett* 88(1-3):349-54.

Morris, K., Morgenlander, M., Coulehan, J. L., Gahagen, S., Arena, V. C., & Morganlander, M. (1990). **Wood-burning stoves and lower respiratory tract infection in American Indian children [published erraturn appears in Am J Dis Child 1990 Apr;144(4):4901.** *Am J Dis Child* 144(1):105-8.

Osborne, J., & Honicky, R. (1990). **Health effects of heating with woodburning stoves: a prospective study of chronic symptoms of respiratory disease in young children.** Paper presented at the Proceedings of the 5th International Conference on Indoor Air Quality and Climate, July 29- August 3, Toronto, Canada.

Pandey, M.R., Regmi, H.N., Neupane, R.P., Gautam, A., & Bhandari, D.P. (1985). **Domestic smoke pollution and respiratory function in rural Nepal.** *Tokai J Exp Clin Med* 10(4):471-81.

Pandey, M. (1997). **Women, wood energy and health.** *Wood Energy News,* 12(l), 3-5.

Perez-Padilla, R., Regalado, J., Vedal, S., Pare, P., Chapela, R., Sansores, R., & Selman, M. (1996). **Exposure to biomass smoke and chronic airway disease in Mexican women. A case-control study.** *Am J Respir Crit Care Med* 154(3 Pt 1):701-6.

Pierson, W.E., Koenig, J.Q., & Bardana, E.J., Jr. (1989). **Potential adverse health effects of wood smoke.** *West J Med* 151(3):339-42.

Robin, LF., Less, P.S., Winget, M., Steinhoff, M., Moulton, L.H., Santosham, M., & Correa, A. (1996). **Wood-burning stoves and lower respiratory illnesses in Navajo children.** *Pediatr Infect Dis J* 15(10):859-65.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1987). **Respiratory effects of indoor air pollution.** *J Allergy Clin Immunol* 79(5):685-700.

Sandoval, J., Salas, J., Martinez-Guerra, M. L., Gomez, A., Martinez, C., Portales, A., Palomar, A., Villegas, M., & Barrios, R. (1993). **Pulmonary arterial hypertension and cor pulmonale associated with chronic domestic woodsmoke inhalation.** *Chest* 103(1):12-20.

Tuthill, R.W. (1984). **Woodstoves, formaldehyde, and respiratory disease.** *Am J Epidemiol* 120(6):952-5.

Wafula, E.M., Onyango, F.E., Thairu, H., Boleij, J.S., Hoek, F., Ruigewaard, P., Kagwanja, S., De Koning, H., Pio, A., Kimani, E., & et al. (1990). **Indoor air pollution in a Kenyan village.** *East Afr Med J,* 67(l), 24-32.

Wesley, A.G., & Loening, W.E. (1996). **Assessment and 2-year follow-up of some factors associated with severity of respiratory infections in early childhood.** *S Afr Med J* 86(4):365-8.

OTHER BIOMASS

Anderson, H.R. (1979). **Respiratory abnormalities, smoking habits and ventilatory capacity in a highland community in Papua New Guinea: prevalence and effect on mortality.** *Int J Epidemiol,* 8(2):127-35.

Armstrong, J.R., & Campbell, H. (1991). **Indoor air pollution exposure and lower respiratory infections in young Gambian children.** *Int J Epidemiol* 20(2):424-9.

Awasthi, S., Glick~ H. A., Fletcher, R. H., & Ahmed, N. (1996). **Ambient air pollution & respiratory symptoms complex in preschool children.** *Indian J Med Res* 104:257-62.

Azizi, B.H., & Henry, R.L. (1990). **Effects of indoor air pollution on lung function of primary school children in Kuala Lumpur.** *Pediatr Pulmonol* 9(1):24-9.

Azizi, B.H., & Henry, R.L. (1991). **The effects of indoor environmental factors on respiratory illness in primary school children in Kuala Lumpur.** *Int J Epidemiol* 20(1):144-50.

Behera, D., & Jindal, S.K. (1991). **Respiratory symptoms in Indian women using domestic cooking fuels.** *Chest* 100(2):385-8.

Berwick, M. (1984). **Respiratory illness in children exposed to unvented combustion sources.** In B. B & L. T (Eds.), *Radon, passive smoking, particulates and housing epidemiology* (pp. 255-260). Stockholm, Sweden: Swedish Council for Building Research.

Boleij, J.S., & Brunekreef, B. (1989). **Domestic pollution as a factor causing respiratory health effects.** *Chest* 96(3 Suppl):368S-372S.

Campbell, H., Armstrong, J. R., & Byass, P. (1989). **Indoor air pollution in developing countries and acute respiratory infection in children [letter].** *Lancet* 1(8645):1012.

Chalise, S., Davidson, M., & Desowitz, R. (1985). **Domestic smoke pollution and respiratory illness in developing countries: Communique to the international medical and public health communities** (Unpublished). Honolulu, Hawaii: East-West Center.

Chen, B.H., Hong, C.J., Pandey, M.R., & Smith, K.R. (1990). **Indoor air pollution in developing countries.** *World Health Stat Q* 43(3):127-38.

Colley, J. R., Douglas, J. W., & Reid, D. D. (1973). **Respiratory disease in young adults: influence of early childhood lower respiratory tract illness, social class, air pollution, and smoking.** *Br Med J* 3(873):195-8.

Corea-Villasenor, A., Matanoski, G., Breysee, P., & Bautista, L. (1992). **Charcoal smoke and acute respiratory infections in children.** *The Quarterly Newsletter of the Centerfor Indoor Air Research* 2(1):1-3.

Cui, J., & MacKay, R. (1993). **Effects of passive smoking on respiratory illness from birth to age eighteen months, in Shanghai, People's Republic of China.** *The Journal of Pediatrics* 123(4):553-8.

Daigler, G.E., Markello, S.J., & Cummings, K.M. (1991). **The effect of indoor air pollutants on otitis media and asthma in children.** *Laryngoscope* 101(3):293-6.

de Francisco, A., Morris, J., Hall, A.J., Armstrong Schellenberg, J.R., & Greenwood, B.M. (1993). **Risk factors for mortality from acute lower respiratory tract infections in young Gambian children [see comments].** *Int J Epidemiol* 22(6):1174-82.

de Koning, H.W., Smith, K.R., & Last, J.M. (1985). **Biomass fuel combustion and health.** *Bull World Health Organ* 63(1):11-26.

Dennis, R.J., Maldonado, D., Norman, S., Baena, E., & Martinez, G. (1996). **Woodsmoke exposure and risk for obstructive airways disease among women.** *Chest* 109(1):115-9.

Dhar, S., & Pathania, A. (1991). **Bronchitis due to biomass fuel burning in North India: "Guijjar Lung," an extreme effect.** *Seminars in Respiratory Medicine* 12(2):69-74.

Dodge, R. (1982). **The effects of indoor pollution on Arizona children.** *Arch Environ Health* 37(3):151-5.

Dossing, M., Khan, J., & al-Rabiah, F. (1994). **Risk factors for chronic obstructive lung disease in Saudi Arabia.** *Respi Med* 88(7):519-22.

Florig, H. (1997). **China's air pollution risks.** *Environmental Science & Technology* 31(6): 274A-279A.

Garcia-Marcos, L, Guillen Perez, J.J., Niguez, J.C., & Guillen Marco, A. (1993). **[Air pollution and respiratory disease in children. Experience in Cartagena].** *An Esp Pediatr* 39 Suppl 55, 83-5.

Gharaibek N.S. (1996). **Effects of indoor air pollution on lung function of primary school children in Jordan.** *Ann Trop Paediatr* 16(2):97-102.

Goren, A.L, & Hellmann, S. (1995). **Respiratory conditions among schoolchildren and their relationship to environmental tobacco smoke and other combustion products.** *Arch Environ Health* 50(2):112-8.

Grobbelaar, J.P., & Bateman, E.D. (199 1). **Hut lung: a domestically acquired pneumoconiosis of mixed aetiology in rural women [published erraturn appears in Thorax 1991 Jul;46(7):544].** *Thorax* 46(5):334-40.

Guneser, S., Atici, A., Alparslan, N. & Cinaz, P. (1994). **Effects of indoor environmental factors on respiratory systems of children.** *J Trop Pediatr* 40(2):114-6.

Henry, C.J., Fishbein, L., Meggs, W.J., Ashford, N.A., Schulte, P.A., Anderson, H., Osborne, J.S., & Sepkovic, D.W. (1991). **Approaches for assessing health risks from complex mixtures in indoor air: a panel overview.** *Environ Health Perspect* 95:135-43.

Hong, C. (1991). **Health aspects of domestic use of biomass and coal in China.** Geneva: WHO.

Johnson, A.W., & Aderele, W.I. (1992). **The association of household pollutants and socio-economic risk factors with the short-terin outcome of acute lower respiratory infections in hospitalized pre-school Nigerian children.** *Ann Trop Paediatr* 12(4):421-32.

Malik, S.K (1985). **Exposure to domestic cooking fuels and chronic bronchitis.** *Indian J Chest Dis Allied Sci* 27(3):171-4.

Marbury, M.C., Maldonado, G., & Waller, L. (1996). **The indoor air and children's health study: methods and incidence rates.** *Epidemiology* 7(2):166-74.

Menezes, A.M., Victora, C.G., & Rigatto, M. (1994). **Prevalence and risk factors for chronic bronchitis in Pelotas, RS, Brazil: a population-based study.** *Thorax* 49(12):1217-21.

Neas, L.M., Dockery, D.W., Ware, J.H., Spengler, J.D., Ferris, B.G., Jr., & Speizer, F.E. (1994). **Concentration of indoor particulate matter as a determinant of respiratory health in children [see comments].** *Am J Epidemiol* 139(11):1088-99.

Norboo, T., Yahya, M., Bruce, N.G., Heady, J.A., & Ball, K.P. (1991). **Domestic pollution and respiratory illness in a Himalayan village.** *Int J Epidemiol* 20(3):749-57.

0. Dempsey, T., McArdle, T.F., Morris, J., Lloyd-Evans, N., Baldeh, I., Laurence, B.E., Secka, 0., & Greenwood, B.M. (1996). **A study of risk factors for pneumococcal disease among children in a rural area of west Africa.** *Int i Epidentiol* 25(4):885-93.

Ogston, S. A., Florey, C. D., & Walker, C. H. (1987). **Association of infant alimentary and respiratory illness with parental smoking and other environmental factors.** *J Epidemiol Community Health* 41(1):21-5.

Ostro, B.D. (1989). **Estimating the risks of smoking, air pollution, and passive smoke on acute respiratory conditions.** *Risk Anal* 9(2):189-96.

Pandey, M.R., Regmi, H.N., Neupane, R.P., Gautam, A., & Bhandari, D.P. (1985). **Domestic smoke pollution and respiratory function in rural Nepal.** *Tokai J Exp Clin Med* 10(4):471-81.

Pandey, M., Neapane, R., & Gautam, A. (1987). **Domestic smoke pollution and acute respiratory infection in Nepal. Paper presented at the Indoor Air '87:** Proceedings of the 4th International Conference on Indoor Air Quality and Climate, 17-21 August, Berlin (West).

Pandey, M., Basnyat, B., & Neupane, R. (1988). **Chronic Bronchitis and Cor Pulmonale in Nepal.** (First ed.). Kathmandu, Nepal: Mrigendra Medical Trust.

Pandey, M.R., Boleij, J.S., Smith, K.R., & Wafula, E.M. (1989). **Indoor air pollution in developing countries and acute respiratory infection in children.** *Lancet* 1(8635):427-9.

Pandey, M., Neupane, R., Gautam, A., & Shrestha, 1. (1989). **Domestic smoke pollution and acute respiratory infections in a rural community of the hill region of Nepal.** *Environment International* 15:337-340.

Perez-Padifla, R., Regalado, J., Vedal, S., Pare, P., Chapela, R., Sansores, R., & Selman, M. (1996). **Exposure to biomass smoke and chronic airway disease in Mexican women. A case-control study.** *Am J Respir Crit Care Med* 154(3 Pt 1):701-6.

Sarnet, J.M., Marbury, M.C., & Spengler, J.D. (1987). **Health effects and sources of indoor air pollution. Part 1.** *Am Rev Respir Dis* 136(6):1486-508.

Samet, J. M., Marbury, M. C., & Spengler, J. D. (1987). **Respiratory effects of indoor air pollution.** *J Allergy Clin Immunol* 79(5):685-700.

Sarnet, J.M., & Speizer, F.E. (1993). **Assessment of health effects in epiderniologic studies of air pollution.** *Environ Health Perspect* 101(Suppl 4):149-54.

Samet, J.M., Smith, K.R., & Romeiu, 1. (1997). **Air Pollution and ARI: a Review.** In B. Kirkwood, et al. (Eds.), *Interventions to Reduce Morbidity and Mortality from Pneumonia in Children*. London: London School of Hygiene and Tropical Medicine (forthcoming).

Sandoval, J., Salas, J., Martinez-Guerra, M.L, Gomez, A., Martinez, C., Portales, A., Palomar, A., Villegas, M., & Barrios, R. (1993). **Pulmonary arterial hypertension and cor pulmonale associated with chronic domestic woodsmoke inhalation.** *Chest* 103(1):12-20.

Smith, K.R. (1987). **Biofuels, air pollution, and health: a global review.** New York: Plenum Press.

Smith, K, ed., (1992). **Epidemiological, Social and Technical Aspects of Air Pollution from Biomass Fuel** (Report of a WHO Consultation WHO/PEP/92.3A). Geneva: World Health Organization.

Smith, K. (1994). **The health impact of cookstove smoke in Africa.** In H. Research Group on African Development Perspectives Bremen: Bass, J. Franz, E. Grawert, W. Hein, R. Kappel, F. Messner, J. Pohlan, & K. Wohlmuth (Eds.), *African Development Perspectives Yeabook 1992-1993: Energy and Sustainable Development* (Vol. 3, pp. 417-434). Hamburg: Lit Verlag.

Smith, K.R. (1996). **Indoor air pollution in India [editorial].** *Natl Med J India* 9(3):103-4.

Smith, K (1996). **Indoor air pollution in developing countries: growing evidence of its role in the global burden of disease.** In K. Ikeda & T. Iwata (Eds.), *Indoor Air '96: The 7th International Conference on Indoor Air Quality and Climate* (Vol. 3, pp. 33-44). Tokyo: Institute of Public Health.

Surjadi, C. (1993). **Respiratory diseases of mothers and children and environmental factors among households in Jakarta.** *Environment and Urbanization* 5(2):78-86.

Tatotschenko, W.K, & Nesterenko, S.W. (1990). **[Effect of moderate pollutant concentrations in the air and incidence of respiratory diseases in children].** *Z Erkr Atmungsorgane* 174(3):185-9.

Turnwesigire, S.G., & Barton, T. (1995). **Environmental risk factors for acute respiratory infections among children of military personnel in Uganda.** *East Afr Med J* 72(5):290-4.

Verma, B.K, & Thakur, D.K (1995). **Effect of stressful environmental factors upon neonatal immune system.** *Cent Eur J Public Health* 3(1):25-9.

Volkmer, R.E., Ruffin, R.E., Wigg, N.R., & Davies, N. (1995). **The prevalence of respiratory symptoms in South Australian preschool children. H. Factors associated with indoor air quality.** *J Paediatr Child Health* 31(2):116-20.

Wafula, E.M., Onyango, F.E., Thairu, H., Boleij, J.S., Hoek, F., Ruigewaard, P., Kagwanja, S., De Koning, H., Pio, A., Kimani, E., & et al. (1990). **Indoor air pollution in a Kenyan village.** *East Afr Med J* 67(1):24-32.

Wesley, A.G., & Loening, W.E. (1996). **Assessment and 2-year follow-up of some factors associated with severity of respiratory infections in early childhood.** *S Afir Med J* 86(4):365-8.

Woodward, A., Douglas, R. M., Graham, N. M., & Miles, H. (1990). **Acute respiratory illness in Adelaide children: breast feeding modifies the effect of passive smoking.** *J Epidemiol Community Health* 44(3), 224-30.

Zwi, S., Davies, J.C., Becklake, M.R., Goldman, H.I., Reinach, S.G., & Kallenbach, J.M. (1990). **Respiratory health status of children in the eastern Transvaal highveld.** *S Afr Med J* 78(11):647-53.

OTHER SOURCES

Aldous, M.B., Holberg, C.J., Wright, A.L., Martinez, F.D., & Taussig, L.M. (1996). **Evaporative cooling and other home factors and lower respiratory tract illness during the first year of life.** Group Health Medical Associates. *Am Jepidemiol* 143(5):423-30.

Azizi, B.H., & Henry, R.L. (1990). **Effects of indoor air pollution on lung function of primary school children in Kuala Lumpur.** *Pediatr Pulmonol* 9(1):24-9.

Azizi, B.H., & Henry, R.L. (1991). **The effects of indoor environmental factors on respiratory illness in primary school children in Kuala Lumpur.** *Int J Epidemiol* 20(1):144-50.

Behera, D., & Jindal, S.K. (1991). **Respiratory symptoms in Indian women using domestic cooking fuels.** *Chest* 100(2):385-8.

Bladen, W.A. (1983). **Relationship between acute respiratory illness and air pollution in an India industrial city.** *Journal of the Air Pollution Control Association* 33(3):226-7.

Chen, B.H., Hong, C.J., Pandey, M.R., & Smith, K.R. (1990). **Indoor air pollution in developing countries.** *World Health Stat Q* 43(3):127-38.

Cui, J., & MacKay, R. (1993). **Effects of passive smoking on respiratory illness from birth to age eighteen months, in Shanghai, People's Republic of China.** *The Journal of Pediatrics* 123(4):553-8.

Dennis, R.J., Maldonado, D., Norman, S., Baena, E., & Martinez, G. (1996). **Woodsmoke exposure and risk for obstructive airways disease among women.** *Chest* 109(l):115-9.

Dodge, R. (1982). **The effects of indoor pollution on Arizona children.** *Arch Environ Health* 37(3):151-5.

Ellegard, A. (1996). **Cooking fuel smoke and respiratory symptoms among women in low-income areas in Maputo.** *Environ Health Perspect* 104(9):980-5.

Femi-Pearse, D., Adeniyi-Jones, A., & Oke, a. (1973). **Respiratory symptoms and their relationship to cigarettesmoking, dusty occupations and domestic air pollution: studies in random sample of an urban African population.** *West Afr Med J Niger Med Dent Pract* 22(3):57-63.

Florig, H. (1997). **China's air pollution risks.** *Environmental Science & Technology* 31(6):274A-279A.

Gharaibeh, N.S. (1996). **Effects of indoor air pollution on lung function of primary school children in Jordan.** *Ann Trop Paediatr* 16(2):97-102.

Goren, A.I., & Hellmann, S. (1995). **Respiratory conditions among schoolchildren and their relationship to environmental tobacco smoke and other combustion products.** *Arch Environ Health* 50(2):112-8.

Graham, N.M. (1990). **The epidemiology of acute respiratory infections in children and adults: a global perspective.** *Epidemiol Rev* 12:149-78.

Henry, C.J., Fishbein, L., Meggs, W.J., Ashford, N.A., Schulte, P.A., Anderson, H., Osborne, J.S., & Sepkovic, D.W. (1991). **Approaches for assessing health risks from complex mixtures in indoor air: a panel overview.** *Environ Health Perspect* 95:135-43.

Johnson, A.W., & Aderele, W.I. (1992). **The association of household pollutants and socio-economic risk factors with the short-term outcome of acute lower respiratory infections in hospitalized pre-school Nigerian children.** *Ann Trop Paediatr* 12(4):421-32.

Koenig, J.Q. (1988). **Indoor and outdoor pollutants and the upper respiratory tract.** *J Allergy Clin Immunol* 81(5 Pt 2):1055-9.

Marbury, M.C., Maldonado, G., & Waller, L. (1996). **The indoor air and children's health study: methods and incidence rates.** *Epidemiology* 7(2):166-74.

Mtango, F.D., Neuvians, D., Broome, C.V., Hightower, A.W., & Pio, A. (1992). **Risk factors for deaths in children under 5 years old in Bagamoyo district, Tanzania.** *Trop Med Parasitol* 43(4):229-33.

Murtagh, P., Cerqueiro, C., Halac, A., Avila, M., Salomon, H., & Weissenbacher, M. (1993). **Acute lower respiratory infection in Argentinian children: a 40 month clinical and epidemiological study.** *Pediatr Pulmonol* 16(1):1-8.

Ogston, S.A., Florey, C.D., & Walker, C.H. (1987). **Association of infant alimentary and respiratory illness with parental smoking and other environmental factors.** *J Epidemiol Community Health* 41(1):21-5.

Pershagen, G., Rylander, E., Norberg, S., Eriksson, M., & Nordvall, S.L. (1995). **Air pollution involving nitrogen dioxide exposure and wheezing bronchitis in children.** *Int J Epidemiol* 24(6):1147-53.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1987). **Health effects and sources of indoor air pollution. Part 1.** *Am Rev RespirDis* 136(6):1486-508.

Samet, J.M., & Spengler, J.D. (1989). **Nitrogen dioxide and respiratory infection: pilot investigations.** *Res Rep Health Eff Inst* (28):1-32.

Samet, J.M., Lambert, W.E., Skipper, B.J., Cushing, A.H., Hunt, W.C., Young, S.A., McLaren, L.C., Schwab, M., & Spengler, J.D. (1993). **Nitrogen dioxide and respiratory illnesses in infants.** *Am Rev Respir Dis* 148(5):1258-65.

Samet, J.M., Lambert, W.E., Skipper, B.J., Cushing, A.H., Hunt, W.C., Young, S.A., McLaren, L.C., Schwab, M., & Spengler, J.D. (1993). **Nitrogen dioxide and respiratory illness in children. Part 1: Health outcomes.** *Res Rep Health Eff Inst* (58):1-32; discussion 51-80.

Selgrade, M., & Gilmour, M. (1994). **Effects of gaseous air pollutants on immune responses and susceptibility to infectious and allergic disease.** In J. Dean, M. Luster, A. Munson, & I. Kimber (Eds.), *Immunotoxicology and Immunopharmacology* (Second ed., pp. 395-411). New York: Raven Press, Ltd.

Spengler, J.D., Schwab, M., McDermott, A., Lambert, W.E., & Samet, J.M. (1996). **Nitrogen dioxide and respiratory illness in children. Part IV: Effects of housing and meteorologic factors on indoor nitrogen dioxide concentrations.** *Res Rep Health Eff Inst* (58):1-29; discussion 31-6.

Turnwesigire, S.G., & Barton, T. (1995). **Environmental risk factors for acute respiratory infections among children of military personnel in Uganda.** *East Afr Med J* 72(5):290-4.

Tuthill, R.W. (1984). **Woodstoves, formaldehyde, and respiratory disease.** *Am J Epidemiol* 120(6):952-5.

Viegi, G., Paoletti, P., Carrozzi, L., Vellutini, M., Ballerin, L., Biavati, P., Nardini, G., Di Pede, F., Sapigni, T., Lebowitz, M.D., & et al. (1991). **Effects of home environment on respiratory symptoms and lung function in a general population sample in north Italy.** *Eur Respir J* 4(5):580-6.

Viegi, G., Carrozzi, L., Paoletti, P., Vellutini, M., DiViggiano, E., Baldacci, S., Modena, P., Pedreschi, M., Mammini, U., di Pede, C., & et al. (1992). **Effects of the home environment on respiratory symptoms of a general population sample in middle Italy.** *Arch Environ Health* 47(1):64-70.

Volkmer, R.E., Ruffin, R.E., Wigg, N.R., & Davies, N. (1995). **The prevalence of respiratory symptoms in South Australian preschool children. 111. Factors associated with indoor air quality.** *J Paediatr Child Health* 31(2):116-20.

Woodward, A., Douglas, R.M., Graham, N.M., & Miles, H. (1990). **Acute respiratory illness in Adelaide children: breast feeding modifies the effect of passive smoking.** *J Epidemiol Community Health* 44(3):224-30.

LATIN AMERICA AND CARIBBEAN

CENTRAL AMERICA

Boy, E., Rivera, J., & Delgado, H. (1992). **Study of Risk Factors for Low Birth Weight in Quetzaltenango.** Institute of Nutrition of Central America and Panama.

MEXICO

Perez-Padilla, R., Regalado, J., Vedal, S., Pare, P., Chapela, R., Sansores, R., & Selman, M. (1996). **Exposure to biomass smoke and chronic airway disease in Mexican women. A case-control study.** *Am J Respir Crit Care Med* 154(3 Pt 1):701-6.

Sandoval, J., Salas, J., Martinez-Guerra, M.L, Gomez, A., Martinez, C., Portales, A., Palomar, A., Villegas, M., & Barrios, R. (1993). **Pulmonary arterial hypertension and cor pulmonale associated with chronic domestic woodsmoke inhalation.** *Chest* 103(1):12-20.

SOUTH AMERICA

Albalak, R. (1997). **Cultural practices and exposure to particulate pollution from indoor biomass cooking: effects on respiratory health and nutritional status among the Aymara Indians of the Bolivian Highlands.** Unpublished Doctoral dissertation, University of Michigan.

Dennis, R.J., Maldonado, D., Norman, S., Baena, E., Castano, H., Martinez, G., & Velez, J.R. (1996). **Wood smoke exposure and risk for obstructive airways disease among women.** *Chest* 109(3 Suppl):55S-56S.

Dennis, R.J., Maldonado, D., Norman, S., Baena, E., & Martinez, G. (1996). **Woodsmoke exposure and risk for obstructive airways disease among women.** *Chest* 109(1):115-9.

Fonseca, W., Kirkwood, B.R., Victora, C.G., Fuchs, S.R., Flores, J.A., & Misago, C. (1996). **Risk factors for childhood pneumonia among the urban poor in Fortaleza, Brazil: a case—control study.** *Bull World Health Organ* 74(2):199-208.

Menezes, A.M., Victora, C.G., & Rigatto, M. (1994). **Prevalence and risk factors for chronic bronchitis in Pelotas, RS, Brazil: a population-based study.** *Thorax* 49(12):1217-21.

Murtagh, P., Cerqueiro, C., Halac, A., Avila, M., Salomon, H., & Weissenbacher, M. (1993). **Acute lower respiratory infection in Argentinian children: a 40 month clinical and epidemiological study.** *Pediatr Pulmonol* 16(1):1-8.

Perma, M.L., & Duchiade, M.P. (1991). **[Air pollution and infant mortality from pneumonia].** *Bol Oficina Sanit Panam* 110(3):199-207. [Portuguese]

Penna, M.L., & Duchiade, M.P. (1991). **Air pollution and infant mortality from pneumonia in the Rio de Janeiro metropolitan area.** *Bull Pan Am Health Organ* 25(1):47-54.

Saldiva, P.H., Lichtenfels, A.J., Paiva, P.S., Barone, I.A., Martins, M.A., Massad, E., Pereira, J.C., Xavier, V.P., Singer, J.M., & Bohm, G.M. (1994). **Association between air pollution and mortality due to respiratory diseases in children in Sao Paulo, Brazil: a preliminary report.** *Environ Res* 65(2):218-25.

Sobral, H.R. (1989). **Air pollution and respiratory diseases in children in Sao Paulo, Brazil.** *Soc Sci Med* 29(8):959-64.

MIDDLE-EASTERN CRESCENT

Dossing, M., Khan, J., & al-Rabiah, F. (1994). **Risk factors for chronic obstructive lung disease in Saudi Arabia.** *Respir Med* 88(7):519-22.

Gharaibeh, N.S. (1996). **Effects of indoor air pollution on lung function of primary school children in Jordan.** *Ann Trop Paediatr* 16(2):97-102.

Goren, A.I., Hellman, S., Brenner, S., Egoz, N., & Rishpon, S. (1990). **Prevalence of respiratory conditions among schoolchildren exposed to different levels of air pollutants in the Haifa Bay area, Israel.** *Environ Health Perspect* 89:225-31.

Goren, A.I., & Hellmann, S. (1995). **Respiratory conditions among schoolchildren and their relationship to environmental tobacco smoke and other combustion products.** *Arch Environ Health* 50(2):112-8.

OTHER ASIA AND ISLANDS

MALAYSIA

Azizi, B.H., & Henry, R.L. (1990). **Effects of indoor air pollution on lung function of primary school children in Kuala Lumpur.** *Pediatr Pulmonol* 9(1):24-9.

Azizi, B.H., & Henry, R.L. (1991). **The effects of indoor environmental factors on respiratory illness in primary school children in Kuala Lumpur.** *Int J Epidemiol* 20(1):144-50.

Azizi, B.H., Zulkifli, H.I., & Kasim, M.S. (1995). **Protective and risk factors for acute respiratory infections in hospitalized urban Malaysian children: a case control study.** *Southeast Asian J Trop Med Public Health* 26(2):280-5.

NEPAL

Chen, B.H., Hong, C.J., Pandey, M.R., & Smith, K.R. (1990). **Indoor air pollution in developing countries.** *World Health Stat Q* 43(3),:127-38.

Pandey, M. (1984). **Domestic smoke pollution and chronic bronchitis in a rural community of the hill region of Nepal.** *Thorax* 39:337-339.

Pandey, M. R., Regmi, H. N., Neupane, R. P., Gautarn, A., & Bhandari, D. P. (1985). **Domestic smoke pollution and respiratory function in rural Nepal.** *Tokai J Exp Clin Med* 10(4):471-81.

Pandey, M., Neapane, R., & Gautam, A. (1987, 17-21 August). **Domestic smoke pollution and acute respiratory infection in Nepal.** Paper presented at the Indoor Air '87: Proceedings of the 4th International Conference on Indoor Air Quality and Climate, Berlin (West).

Pandey, M., Basnyat, B., & Neupane, R. (1988). **Chronic Bronchitis and Cor Pulmonale in Nepal.** (First ed.). Kathmandu, Nepal: Mrigendra Medical Trust.

Pandey, M., Neupane, R., Gautam, A., & Shrestha, I. (1989). **Domestic smoke pollution and acute respiratory infections in a rural community of the hill region of Nepal.** *Environment International* 15:337-340.

Pierson, W.E., Koenig, J.Q., & Bardana, E. J., Jr. (1989). **Potential adverse health effects of wood smoke.** *West J Med* 151(3):339-42.

PAPUA NEW GUINEA

Anderson, H.R. (1978). **Respiratory abnormalities in Papua New Guinea children: the effects of locality and domestic wood smoke pollution.** *Int J Epidemiol* 7(1):63-72.

Anderson, H.R. (1979). **Chronic lung disease in the Papua New Guinea Highlands.** *Thorax* 34(5):647-53.

Anderson, H.R. (1979). **Respiratory abnormalities, smoking habits and ventilatory capacity in a highland community in Papua New Guinea: prevalence and effect on mortality.** *Int J Epidemiol* 8(2):127-35.

OTHER

Guha-Sapir, D. (1996). **Environment of urban poor communities in Asia: study on the effects of indoor air pollution among infants in Delhi and Manila** (Final Report (draft)). Brussels: Catholic University of Louvain, Department of Public Health.

Surjadi, C. (1993). **Respiratory diseases of mothers and children and environmental factors among households in Jakarta.** *Environment and Urbanization* 5(2):78-86.

OTITIS MEDIA

Daigler, G.E., Markello, S.J., & Cummings, K.M. (1991). **The effect of indoor air pollutants on otitis media and asthma in children.** *Laryngoscope* 101(3):293-6.

Kim, P.E., Musher, D.M., Glezen, W.P., Rodriguez-Barradas, M.C., Nahm, W.K., & Wright, C.E. (1996). **Association of invasive pneumococcal disease with season, atmospheric conditions, air pollution, and the isolation of respiratory viruses.** *Clin Infect Dis* 22(1):100-6.

Koltai, P.J. (1994). **Effects of air pollution on the upper respiratory tract of children.** *Otolaryngol Head Neck Surg* 111(1)L 9-11.

PERINATAL EFFECTS

Boy, E., Rivera, J., & Delgado, H. (1992). **Study of Risk Factors for Low Birth Weight in Quetzaltenango:** Institute of Nutrition of Central America and Panama.

Mavalankar, D.V., Trivedi, C.R., & Grab, R.H. (1991). **Levels and risk factors for perinatal mortality in Ahmedabad, India.** *Bulletin of WHO* 69(4):435-442.

Sram, R.J., Benes, I., Binkova, B., Dejmek, J., Horstman, D., Kotesovec, F., Otto, D., Perreault, S.D., Rubes, J., Selevan, S.G., Skalik, I., Stevens, R.K., & Lewtas, J. (1996). **Teplice program—the impact of air pollution on human health.** *Environ Health Perspect* 104 (Suppl 4):699-714.

Wang, X., Ding, H., Ryan, L., & Xu, X. (1997). **Association between air pollution and low birth weight: a community-based study.** *Environmental Health Perspectives* 105(5):514-520.

Woodruff, T.J., Grillo, J., & Schoendorf, K.G. (1997). **The relationship between selected causes of postneonatal infant mortality and particulate air pollution in the United States.** *Environmental Health Perspectives* 105(6):608-612.

Woodward, A., Douglas, R.M., Graham, N.M., & Miles, H. (1990). **Acute respiratory illness in Adelaide children: breast feeding modifies the effect of passive smoking.** *J Epidemiol Community Health* 44(3):224-30.

Xu, X, Ding, H., & Wang, X. (1995). **Acute effects of total suspended particles and sulfur dioxides on preterm delivery: a community-based cohort study.** *Arch Environ Health* 50(6):407-15.

PNEUMONIA

Albalak, R. (1997). **Cultural practices and exposure to particulate pollutionfrom indoor biomass cooking: effects on respiratory health and nutritional status among the Aymara Indians of the Bolivian Highlands.** Unpublished Doctoral dissertation, University of Michigan.

Azizi, B.H., ZulVjfli, H.I., & Kasim, M.S. (1995). **Protective and risk factors for acute respiratory infections in hospitalized urban Malaysian children: a case control study.** *Southeast Asian J Trop Med Public Health* 26(2):280-5.

Bates, D.V. (1995). **The effects of air pollution on children.** *Environ Health Perspect* 103 (Suppl 6):49-53.

Berman, S. (1991). **Epidemiology of acute respiratory infections in children of developing countries.** *Rev Infect Dis* 13 (Suppl 6):S454-62.

Cui, J., & MacKay, R. (1993). **Effects of passive smoking on respiratory illness from birth to age eighteen months, in Shanghai, People's Republic of China.** *The Journal of Pediatrics* 123(4):553-8.

Fonseca, W., Kirkwood, B.R., Victora, C.G., Fuchs, S.R., Flores, J.A., & Misago, C. (1996). **Risk factors for childhood pneumonia among the urban poor in Fortaleza, Brazil: a case—control study.** *Bull World Health Organ* 74(2):199-208.

Graham, N.M. (1990). **The epidendology of acute respiratory infections in children and adults: a global perspective.** *Epidemiol Rev* 12:149-78.

Guneser, S., Atici, A., Alparslan, N., & Cinaz, P. (1994). **Effects of indoor environmental factors on respiratory systems of children.** *J Trop Pediatr* 40(2):114-6.

Han, C.Y. (1997). **Power, Priorities, and Public Health: A Study of Acute Respiratory Infections and Public Health Intervention in Kenya.** Unpublished Bachelor of Arts, Princeton University, Princeton, New Jersey.

Kim, P.E., Musher, D.M., Glezen, W.P., Rodriguez-Barradas, M.C., Nahm, W.K., & Wright, C.E. (1996). **Association of invasive pneumococcal disease with season, atmospheric conditions, air pollution, and the isolation of respiratory viruses.** *Clin Infect Dis* 22(l):100-6.

Kirkwood, B.R., Gove, S., Rogers, S., Lob-Levyt, J., Arthur, P., & Campbell, H. (1995). **Potential interventions for the prevention of childhood pneumonia in developing countries: a systematic review.** *Bull World Health Organ* 73(6):793-8.

Mishra, S., & Chaturvedi, P. (1995). **Acute respiratory infections with special reference to pneumonia in underfives.** *J Indian Med Assoc* 93(9):351-5.

Mtango, F.D., Neuvians, D., Broome, C.V., Hightower, A.W., & Pio, A. (1992). **Risk factors for deaths in children under 5 years old in Bagamoyo district, Tanzania.** *Trop Med Parasitol* 43(4):229-33.

Murtagh, P., Cerqueiro, C., Halac, A., Avila, M., Salomon, H., & Weissenbacher, M. (1993). **Acute lower respiratory infection in Argentinian children: a 40 month clinical and epidemiological study.** *Pediatr Pulmonol* 16(l):1-8.

0. Dempsey, T., McArdle, T.F., Morris, J., Lloyd-Evans, N., Baldeh, I., Laurence, B.E., Secka, 0., & Greenwood, B.M. (1996). **A study of risk factors for pneumococcal disease among children in a rural area of west Africa.** *Int J Epidemiol* 25(4):885-93.

Penna, M.L., & Duchiade, M.P. (1991). **[Air pollution and infant mortality from pneumonia].** *Bol Oficina Sanit Panam* 110(3):199-207. [Portuguese]

Penna, M.L., & Duchiade, M.P. (199 1). **Air pollution and infant mortality from pneumonia in the Rio de Janeiro metropolitan area.** *Bull Pan Am Health Organ* 25(l):47-54.

Pope, C.A.d. (1989). **Respiratory disease associated with community air pollution and a steel mill, Utah Valley.** *Am J Public Health* 79(5):623-8.

Samet, J.M., Smith, K.R., & Romeiu, I. (1997). **Air Pollution and ARI: a Review.** In B. Kirkwood, et al. (Eds.), *Interventions to Reduce Morbidity and Mortalityfrom Pneumonia in Children.* London: London School of Hygiene and Tropical Medicine (forthcoming).

Schwartz, J. (1994). **What are people dying of on high air pollution days?** *Environ Roes* 64(l):26-35.

Sehgal, S. (1993). **Pneumocystis pneumonia: a time to shed complacence [editorial; comment].** *J Assoc Physicians India* 41(1):5-7.

Shah, N., Ramankutty, V., Premila, P.G., & Sathy, N. (1994). **Risk factors for severe pneumonia in children in south Kerala: a hospital-based case-control study.** *J Trop Pediatr* 40(4):201-6.

Sofoluwe, G.O. (1968). **Smoke pollution in dwellings of infants with bronchopneumonia.** *Arch Environ Health* 16(5):670-2.

Verma, B.K, & Thakur, D.K. (1995). **Effect of stressful environmental factors upon neonatal immune system.** *Cent Eur J Public Health* 3(l):25-9.

Wesley, A.G., & Loening, W.E. (1996). **Assessment and 2-year follow-up of some factors associated with severity of respiratory infections in early childhood.** *S Afr Med J* 86(4):365-8.

POLLUTANTS MEASURED

NITROGENDIOXIDE

Awasthi, S., Glick, H.A., Fletcher, R.H., & Ahmed, N. (1996). **Ambient air pollution & respiratory symptoms complex in preschool children.** *Indian J Med Res* 104:257-62.

Boleij, J.S., & Brunekreef, B. (1989). **Domestic pollution as a factor causing respiratory health effects.** *Chest* 96(3 Suppl):368S-372S.

Braun-Fahrlander, C., Ackermann-Liebrich, U., Schwartz, J., Gnehm, H.P., Rutishauser, M., & Wanner, H.U. (1992). **Air pollution and respiratory symptoms in preschool children.** *Am Rev Respir Dis* 145(1):42-7.

He, Q.C., Ljoy, P.J., Wilson, W.E., & Chapman, R.S. (1993). **Effects of air pollution on children's pulmonary function in urban and suburban areas of Wuhan, People's Republic of China.** *Arch Environ Health* 48(6):382-91.

Hoek, G., & Brunekreef, B. (1995). **Effect of photochemical air pollution on acute respiratory symptoms in children.** *Am J Respir Crit Care Med* 151(1):27-32.

Koltai, P.J. (1994). **Effects of air pollution on the upper respiratory tract of children.** *Otolaryngol Head Neck Surg* 111(1):9-11.

Lercher, P., Schmitzberger, R., & Kofier, W. (1995). **Perceived traffic air pollution, associated behavior and health in an alpine area.** *Sci Total Environ* 169(1-3):71-4.

Pershagen, G., Rylander, E., Norberg, S., Eriksson, M., & Nordvall, S.L. (1995). **Air pollution involving nitrogen dioxide exposure and wheezing bronchitis in children.** *Int J Epidemiol* 24(6):1147-53.

Ponka, A. (1990). **Absenteeism and respiratory disease among children and adults in Helsinki in relation to low-level air pollution and temperature.** *Environ Res* 52(1):34-46.

Roemer, W., Hoek, G., & Brunekreef, B. (1993). **Effect of ambient winter air pollution on respiratory health of children with chronic respiratory symptoms.** *Am Rev Respir Dis* 147(1):118-24.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1987). **Health effects and sources of indoor air pollution. Part 1.** *Am Rev Respir Dis* 136(6):1486-508.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1987). **Respiratory effects of indoor air pollution.** *J Allergy Clin Immunol* 79(5):685-700.

Samet, J.M., & Spengler, J.D. (1989). **Nitrogen dioxide and respiratory infection: pilot investigations.** *Res Rep Health Eff Inst* 28:1-32.

Samet, J.M., Lambert, W.E., Skipper, B.J., Cushing, A.H., Hunt, W.C., Young, S.A., McLaren, L.C., Schwab, M., & Spengler, J.D. (1993). **Nitrogen dioxide and respiratory illnesses in infants.** *Am Rev Respir Dis* 148(5):125 8-65.

Samet, J.M., Lambert, W.E., Skipper, B.J., Cushing, A.H., Hunt, W.C., Young, S.A., McLaren, L.C., Schwab, M., & Spengler, J.D. (1993). **Nitrogen dioxide and respiratory illness in children. Part 1: Health outcomes.** *Res Rep Health Eff Inst* (58):1-32; discussion 51-80.

Schwartz, J., Dockery, D.W., Neas, L.M., Wypij, D., Ware, J.H., Spengler, J.D., Koutrakis, P., Speizer, F.E., & Ferris, B.G., Jr. (1994). **Acute effects of summer air pollution on respiratory symptom reporting in children.** *Am J Respir Crit Care Med* 150(5 Pt 1):1234-42.

Stem, B.R., Raizenne, M.E., Burnett, R.T., Jones, L, Kearney, J., & Franklin, C.A. (1994). **Air pollution and childhood respiratory health: exposure to sulfate and ozone in 10 Canadian rural communities.** *Environ Res* 66(2):125-42.

Tatotschenko, W.K, & Nesterenko, S.W. (1990). **[Effect of moderate pollutant concentrations in the air and incidence of respiratory diseases in children].** *Z Erkr Atmungsorgane* 174(3):185-9.

Wafula, E.M., Onyango, F.E., Thairu, H., Boleij, J.S., Hoek, F., Ruigewaard, P., Kagwanja, S., De Koning, H., Pio, A., Kimani, E., & et al. (1990). **Indoor air pollution in a Kenyan village.** *East Afr Med J* 67(1):24-32.

TOTAL SUSPENDED PARTICULATES

Aunan, K. (1996). **Exposure-response functions for health effects of air pollutants based on epidemiological findings.** *Risk Anal* 16(5):693-709.

Awasthi, S., Gfick, H.A., Fletcher, R.H., & Ahmed, N. (1996). **Ambient air pollution & respiratory symptoms complex in preschool children.** *Indian J Med Res* 104:257-62.

Berwick, M. (1984). **Respiratory illness in children exposed to unvented combustion sources.** In B. B & L. T (Eds.), *Radon, passive smoking, particulates and housing epidemiology (pp.* 255-260). Stockholm, Sweden: Swedish Council for Building Research.

Braun-Fahrlander, C., Ackermann-Liebrich, U., Schwartz, J., Gnehm, H. P., Rutishauser, M., & Wanner, H. U. (1992). **Air pollution and respiratory symptoms in preschool children.** *Am Rev Respir Dis* 145(1):42-7.

Chen, B.H., Hong, C.J., Pandey, M.R., & Smith, K.R. (1990). **Indoor air pollution in developing countries.** *World Health Stat Q* 43(3):127-38.

Collings, D.A., Sithole, S.D., & Martin, K.S. (1990). **Indoor woodsmoke pollution causing lower respiratory disease in children.** *Trop Doct* 20(4):151-5.

Dockery, D.W., Speizer, F.E., Stram, D.O., Ware, J.H., Spengler, J.D., & Ferris, B.G., Jr. (1989). **Effects of inhalable particles on respiratory health of children.** *Am Rev Respir Dis* 139(3):587-94.

Ellegard, A. (1996). **Cooking fuel smoke and respiratory symptoms among women in low-income areas in Maputo.** *Environ Health Perspect* 104(9):980-5.

Grobbelaar, J.P., & Bateman, E.D. (1991). **Hut lung: a domestically acquired pneumoconiosis of mixed aetiology in rural women [published erraturn appears in *Thorax* 1991 Jul;46(7):544].** *Thorax* 46(5):334-40.

He, Q.C., Ljoy, P.J., Wilson, W.E., & Chapman, R.S. (1993). **Effects of air pollution on children's pulmonary function in urban and suburban areas of Wuhan, People's Republic of China.** *Arch Environ Health* 48(6):3 82-91.

Jedrychowski, W., Flak, E., & Mroz, E. (1995). **[Prospective epidemiologic study on respiratory diseases in children in Cracow. Pilot study].** *Przegl Epidemiol* 49(3):331-9. [Polish]

Jedrychowski, W., Flak, E., & Mroz, E. (1996). **[Variability of respiratory system reactions to air pollutants. Epidemiologic study of children in Cracow].** *Pneumonol Alergol Pol* 64(5-6):267-75. [Polish]

Martin, K. (1991). **Indoor air pollution in developing countries.** *The Lancet* 337:358.

Moriske, H.J., Drews, M., Ebert, G., Menk, G., Scheller, C., Schondube, M., & Konieczny, L. (1996). **Indoor air pollution by different heating systems: coal burning, open fireplace and central heating.** *Toxicol Lett* 88(1-3):349-54.

Neas, L.M., Dockery, D.W., Koutrakis, P., Tollerud, D.L, & Speizer, F.E. (1995). **The association of ambient air pollution with twice daily peak expiratory flow rate measurements in children.** *Am J Epidemiol* 141(2):111-22.

Neas, LM., Dockery, D.W., Burge, H., Kouft-akis, P., & Speizer, F.E. (1996). **Fungus spores, air pollutants, and other determinants of peak expiratory flow rate in children.** *Am J Epidemiol* 143(8):797-807.

Ostro, B.D., & Rothschild, S. (1989). **Air pollution and acute respiratory morbidity: an observational study of multiple pollutants.** *Environ Res* 50(2):238-47.

Penna, M.L., & Duchiade, M.P. (1991). **[Air pollution and infant mortality from pneumonia].** Bol *Oficina Sanit Panam* 110(3):199-207.

Penna, M.L., & Duchiade, M.P. (1991). **Air pollution and infant mortality from pneumonia in the Rio de Janeiro metropolitan area.** *Bull Pan Am Health Organ* 25(1):47-54.

Robin, LF., Less, P.S., Winget, M., Steinhoff, M., Moulton, L.H., Santosham, M., & Correa, A. (1996). **Wood-burning stoves and lower respiratory illnesses in Navajo children.** *Pediatr Infect Dis J* 15(10):859-65.

Schlesinger, R.B. (1995). **Interaction of gaseous and particulate pollutants in the respiratory tract: mechanisms and modulators.** *Toxicology* 105(2-3):315-25.

Schwartz, J. (1994). **What are people dying of on high air pollution days?** *Environ Res* 64(1):26-35.

Tatotschenko, W.K, & Nesterenko, S.W. (1990). **[Effect of moderate pollutant concentrations in the air and incidence of respiratory diseases in children].** *Z Erkr Atmungsorgane* 174(3):185-9.

Terblanche, A.P., Opperman, L., Nel, C.M., Reinach, S.G., Tosen, G., & Cadman, A. (1992). **Preliminary results of exposure measurements and health effects of the Vaal Triangle Air Pollution Health Study.** *S Afr Med J* 81(11):550-6.

Utell, M.J., & Sarnet, J.M. (1993). **Particulate air pollution and health. New evidence on an old problem [editorial; comment].** *Am Rev Respir Dis* 147(6 Pt 1):1334-5.

Wafula, E.M., Onyango, F.E., Thairu, H., Boleij, J.S., Hoek, F., Ruigewaard, P., Kagwanja, S., De Koning, H., Pio, A., Kimani, E., & et al. (1990). **Indoor air pollution in a Kenyan village.** *East Afr Med J* 67(1):24-32.

Wang, X., Ding, H., Ryan, L., & Xu, X. (1997). **Association between air pollution and low birth weight: a community-based study.** *Environmental Health Perspectives* 105(5):514-520.

Wichmann, H.E., & Heinrich, J. (1995). **Health effects of high level exposure to traditional pollutants in East Germany—review and ongoing research.** *Environ Health Perspect* 103 (Suppl 2):29-35.

Xu, X., Dockery, D.W., Christiani, D.C., Li, B., & Huang, H. (1995). **Association of air pollution with hospital outpatient visits in Beijing.** *Arch Environ Health* 50(3):214-20.

Xu, X., Ding, H., & Wang, X. (1995). **Acute effects of total suspended particles and sulfur dioxides on preterm delivery: a community-based cohort study.** *Arch Environ Health* 50(6):407-15.

PM_{10} OR SMALLER

Albalak, R. (1997). *Culturalpractices andexposure to particulate pollution from indoorbiomass cooking: effects on respiratory health and nutritional status among the Aymara Indians of the Bolivian Highlands.* Unpublished Doctoral dissertation, University of Michigan.

Awasthi, S., Glick, H. A., Fletcher, R. H., & Ahmed, N. (1996). **Ambient air pollution & respiratory symptoms complex in preschool children.** *Indian J Med Res* 104:257-62.

Dennis, R.J., Maldonado, D., Norman, S., Baena, E., & Martinez, G. (1996). **Woodsmoke exposure and risk for obstructive airways disease among women.** *Chest* 109(1):115-9.

Dockery, D.W., Speizer, F.E., Stram, D.O., Ware, J.H., Spengler, J.D., & Ferris, B.G., Jr. (1989). **Effects of inhalable particles on respiratory health of children.** *Am Rev Respir Dis* 139(3):587-94.

Graham, N.M. (1990). **The epidemiology of acute respiratory infections in children and adults: a global perspective.** *Epidemiol Rev* 12:149-78.

He, Q.C., Loy, P.J., Wilson, W.E., & Chapman, R.S. (1993). **Effects of air pollution on children's pulmonary function in urban and suburban areas of Wuhan, People's Republic of China.** *Arch Environ Health* 48(6):382-91.

Henry, C.J., Fishbein, L., Meggs, W.J., Ashford, N.A., Schulte, P.A., Anderson, H., Osborne, J.S., & Sepkovic, D.W. (1991). **Approaches for assessing health risks from complex mixtures in indoor air: a panel overview.** *Environ Health Perspect* 95:135-43.

Hoek, G., & Brunekreef, B. (1995). **Effect of photochemical air pollution on acute respiratory symptoms in children.** *Am J Respir Crit Care Med* 151(1):27-32.

Koenig, J.Q., Larson, T.V.,Hanley, Q.S., Rebolledo, V., Dumler, K., Checkoway, H., Wang, S.Z., Lin, D., & Pierson, W.E. (1993). **Pulmonary function changes in children associated with fine particulate matter.** *Environ Res* 63(1):26-38.

Kossove, D. (1982). **Smoke-filled rooms and lower respiratory disease in infants.** *S Afr Med J* 61(17):622-4.

Neas, L.M., Dockery, D.W., Ware, J.H., Spengler, J.D., Ferris, B.G., Jr., & Speizer, F.E. (1994). **Concentration of indoor particulate matter as a determinant of respiratory health in children** [see comments]. *Am J Epidemiol* 139(11):1088-99.

Ostro, B.D. (1989). **Estimating the risks of smoking, air pollution, and passive smoke on acute respiratory conditions.** *Risk Anal* 9(2):189-96.

Ostro, B.D., & Rothschild, S. (1989). **Air pollution and acute respiratory morbidity: an observational study of multiple pollutants.** *Environ Res* 50(2):238-47.

Ostro, B. (1993). **The association of air pollution and mortality: examining the case for inference.** *Arch Environ Health* 48(5):336-42.

Pershagen, G., Rylander, E., Norberg, S., Eriksson, M., & Nordvall, S.L. (1995). **Air pollution involving nitrogen dioxide exposure and wheezing bronchitis in children.** *Int J Epidemiol* 24(6):1147-53.

Pope, C.A.d. (1989). **Respiratory disease associated with community air pollution and a steel mill, Utah Valley.** *Am J Public Health* 79(5):623-8.

Pope, C.A.d., Dockery, D.W., Spengler, J.D., & Raizenne, M.E. (1991). **Respiratory health and PM_{10} pollution. A daily time series analysis.** *Am Rev Respir Dis* 144(3 Pt 1):668-74.

Pope, C.A.d., & Dockery, D.W. (1992). **Acute health effects of PM10 pollution on symptomatic and asymptomatic children.** *Am Rev Respir Dis* 145(5):1123-8.

Pope, C.A., 3rd. (1996). **Adverse health effects of air pollutants in a nonsmoking population.** *Toxicology* 111(1-3):149-55.

Pope, C.A., 3rd. (1996). **Particulate pollution and health: a review of the Utah valley experience.** *J Expo Anal Environ Epidemiol* 6(1):23-34.

Ransom, M.R., & Pope, C.A.d. (1992). **Elementary school absences and PM10 pollution in Utah Valley.** *Environ Res* 58(2):204-19.

Robin, LF., Less, P.S., Winget, M., Steinhoff, M., Moulton, L.H., Santosham, M., & Correa, A. (1996). **Wood-burning stoves and lower respiratory illnesses in Navajo children.** *Pediatr Infect Dis J* 15(10):85 9-65.

Robin, L.F., Less, P.S., Winget, M., Steinhoff, M., Moulton, L.H., Santosharn, M., & Correa, A. (1996). **Wood-burning stoves and lower respiratory illnesses in Navajo children.** *Pediatr Infect Dis J* 15(10):859-65.

Roemer, W., Hoek, G., & Brunekreef, B. (1993). **Effect of ambient winter air pollution on respiratory health of children with chronic respiratory symptoms.** *Am Rev Respir Dis* 147(1):118-24.

Roemer, W., Hoek, G., & Brunekreef, B. (1993). **Effect of ambient winter air pollution on respiratory health of children with chronic respiratory symptoms.** *Am Rev Respir Dis* 147(1):118-24.

Saldiva, P.H., Lichtenfels, A.J., Paiva, P.S., Barone, I.A., Martins, M.A., Massad, E., Pereira, J.C., Xavier, V.P., Singer, J.M., & Bohm, G.M. (1994). **Association between air pollution and mortality due to respiratory diseases in children in Sao Paulo, Brazil: a preliminary report.** *Environ Res* 65(2):218-25.

Schwartz, J., Dockery, D.W., Neas, L.M., Wypij, D., Ware, J.H., Spengler, J.D., Koutrakis, P., Speizer, F.E., & Ferris, B.G., Jr. (1994). **Acute effects of summer air pollution on respiratory symptom reporting in children.** *Am J Respir Crit Care Med* 150(5 Pt 1):1234-42.

Schwartz, J., Dockery, D.W., & Neas, L.M. (1996). **Is daily mortality associated specifically with fine particles?** *J Air Waste Manag Assoc* 46(10):927-39.

Smith, K. (1994). **The health impact of cookstove smoke in Africa.** In H. Research Group on African Development Perspectives Bremen: Bass, J. Franz, E. Grawert, W. Hein, R. Kappel, F. Messner, J. Pohlan, & K. Wohlmuth (Eds.), *African Development Perspectives Yeabook 199211993: Energy and Sustainable Development* (Vol. 3, pp. 417-434). Hamburg: Lit Verlag.

Sram, R.J., Benes, I., Binkova, B., Dejmek, J., Horstman, D., Kotesovec, F., Otto, D., Perreault, S.D., Rubes, J., Selevan, S.G., Skalik, I., Stevens, R.K., & Lewtas, J. (1996). **Teplice program—the impact of air pollution on human health.** *Environ Health Perspect* 104 (Suppl 4):699-714.

Stem, B.R., Raizenne, M.E., Burnett, R.T., Jones, L, Kearney, J., & Franklin, C.A. (1994). **Air pollution and childhood respiratory health: exposure to sulfate and ozone in 10 Canadian rural communities.** *Environ Res* 66(2):125-42.

Wafula, E.M., Onyango, F.E., Thairu, H., Boleij, J.S., Hoek, F., Ruigewaard, P., Kagwanja, S., De Koning, H., Pio, A., Kimani, E., & et al. (1990). **Indoor air pollution in a Kenyan village.** *East Afr Med J* 67(1):24-32.

Woodruff, T.J., Grillo, J., & Schoendorf, K.G. (1997). **The relationship between selected causes of postneonatal infant mortality and particulate air pollution in the United States.** *Environmental Health Perspectives* 105(6):608-612.

OTHER POLLUTANTS

(1993). **American Academy of Pediatrics Committee on Environmental Health: Ambient air pollution: respiratory hazards to children.** *Pediatrics* 91(6):1210-3.

Awasthi, S., Glick, H.A., Fletcher, R.H., & Ahmed, N. (1996). **Ambient air pollution & respiratory symptoms complex in preschool children.** *Indian J Med Res* 104:257-62.

Bladen, W.A. (1983). **Relationship between acute respiratory illness and air pollution in an India industrial city.** *Journal of the Air Pollution Control Association* 33(3):226-7.

Braun-Fahrlander, C., Ackermann-Lebrich, U., Schwartz, J., Gnehm, H.P., Rutishauser, M., & Wanner, H.U. (1992). **Air pollution and respiratory symptoms in preschool children.** *Am Rev Respir Dis* 145(1) 42-7.

Chen, B.H., Hong, C.J., Pandey, M.R., & Smith, K.R. (1990). **Indoor air pollution in developing countries.** *World Health Stat Q* 43(3):127-38.

Collings, D.A., Sithole, S.D., & Martin, K.S. (1990). **Indoor woodsmoke pollution causing lower respiratory disease in children.** *Trop Doct* 20(4):151-5.

Dockery, D.W., Speizer, F.E., Stram, D.O., Ware, J.H., Spengler, J.D., & Ferris, B.G., Jr. (1989). **Effects of inhalable particles on respiratory health of children.** *Am Rev Respir Dis* 139(3):587-94.

Garcia-Marcos, L, Guillen Perez, J. J., Niguez, J. C., & Guillen Marco, A. (1993). **[Air pollution and respiratory disease in children. Experience in Cartagena].** *An Esp Pediatr* 39(Suppl 55):83-5. [Spanish]

Grobbelaar, J.P., & Bateman, E.D. (1991). **Hut lung: a domestically acquired pneurnoconiosis of mixed aetiology in rural women [published erraturn appears in *Thorax* 1991 Jul;46(7):544].** *Thorax* 46(5):334-40.

He, Q.C., Lioy, P.J., Wilson, W.E., & Chapman, R.S. (1993). **Effects of air pollution on children's pulmonary function in urban and suburban areas of Wuhan, People's Republic of China.** *Arch Environ Health* 48(6):382-91.

Herbarth, O. (1995). **Risk assessment of environmentally influenced airway diseases based on time-series analysis.** *Environ Health Perspect* 103(9):852-6.

Hoek, G., & Brunelcreef, B. (1995). **Effect of photochemical air pollution on acute respiratory symptoms in children.** *Am J Respir Crit Care Med* 151(1):27-32.

Jedrychowski, W., Flak, E., & Mroz, E. (1995). **[Prospective epiderniologic study on respiratory diseases in children in Cracow. Pilot study].** *Przegl Epidemiol* 49(3):331-9. [Polish]

Jedrychowski, W., Flak, E., & Mroz, E. (1996). **[Variability of respiratory system reactions to air pollutants. Epiderniologic study of children in Cracow].** *Pneumonol Alergol Pol* 64(5-6):267-75. [Polish]

Kim, P.E., Musher, D.M., Glezen, W.P., Rodriguez-Barradas, M.C., Nahm, W.K., & Wright, C.E. (1996). **Association of invasive pneumococcal disease with season, atmospheric conditions, air pollution, and the isolation of respiratory viruses.** *Clin Infect Dis* 22(1):100-6.

Koenig, J.Q. (1988). **Indoor and outdoor pollutants and the upper respiratory tract.** *J Allergy Clin Immunol* 81(5 Pt 2):1055-9.

Koltai, P.J. (1994). **Effects of air pollution on the upper respiratory tract of children.** *Otolaryngol Head Neck Surg* 111(1):9-11.

Moriske, H.J., Drews, M., Ebert, G., Menk, G., Scheller, C., Schondube, M., & Konieczny, L. (1996). **Indoor air pollution by different heating systems: coal burning, open fireplace and central heating.** *Toxicol Lett* 88(1-3):349-54.

Murtagh, P., Cerqueiro, C., Halac, A., Avila, M., Salomon, H., & Weissenbacher, M. (1993). **Acute lower respiratory infection in Argentinian children: a 40 month clinical and epidemiological study.** *Pediatr Pulmonol* 16(1):1-8.

Neas, L.M., Dockery, D.W., Koutrakis, P., Tollerud, D.J., & Speizer, F.E. (1995). **The association of ambient air pollution with twice daily peak expiratory flow rate measurements in children.** *Am J Epidemiol* 141(2):111-22.

Neas, L.M., Dockery, D.W., Burge, H., Koutrakis, P., & Speizer, F.E. (1996). **Fungus spores, air pollutants, and other determinants of peak expiratory flow rate in children.** *Am J Epidemiol* 143(8):797-807.

Norboo, T., Yahya, M., Bruce, N.G., Heady, J.A., & Ball, K.P. (1991). **Domestic pollution and respiratory illness in a Himalayan village.** *Int J Epidemiol* 20(3):749-57.

Ostro, B.D., & Rothschild, S. (1989). **Air pollution and acute respiratory morbidity: an observational study of multiple pollutants.** *Environ Res* 50(2):238-47.

Ostro, B. (1993). **The association of air pollution and mortality: examining the case for inference.** *Arch Environ Health* 48(5):336-42.

Pierson, W.E., Koenig, J.Q., & Bardana, E.J., Jr. (1989). **Potential adverse health effects of wood smoke.** *West J Med* 151(3):339-42.

Ponka, A. (1990). **Absenteeism and respiratory disease among children and adults in Helsinki in relation to low-level air pollution and temperature.** *Environ Res* 52(1):34-46.

Pope, C.A., 3rd. (1996). **Adverse health effects of air pollutants in a nonsmoking population.** *Toxicology* 111(1-3):149-55.

Pope, C.A., 3rd. (1996). **Particulate pollution and health: a review of the Utah valley experience.** *J Expo Anal Environ Epidemiol* 6(1):23-34.

Roemer, W., Hoek, G., & Brunekreef, B. (1993). **Effect of ambient winter air pollution on respiratory health of children with chronic respiratory symptoms.** *Am Rev Respir Dis* 147(1):118-24.

Saldiva, P.H., Uchtentels, A.J., Paiva, P.S., Barone, I.A., Martins, M.A., Massad, E., Pereira, J.C., Xavier, V.P., Singer, J.M., & Bohm, G.M. (1994). **Association between air pollution and mortality due to respiratory diseases in children in Sao Paulo, Brazil: a preliminary report.** *Environ Res* 65(2):218-25.

Schwartz, J., Dockery, D.W., Neas, L.M., Wypij, D., Ware, J.H., Spengler, J.D., Koutrakis, P., Speizer, F.E., & Ferris, B.G., Jr. (1994). **Acute effects of summer air pollution on respiratory symptom reporting in children.** *Am J Respir Crit Care Med* 150(5 Pt 1):1234-42.

Sofoluwe, G.O. (1968). **Smoke pollution in dwellings of infants with bronchopneumonia.** *Arch Environ Health* 16(5):670-2.

Sram, R.J., Benes, I., Binkova, B., Dejmek, J., Horstman, D., Kotesovec, F., Otto, D., Perreault, S.D., Rubes, J., Selevan, S.G., Skalik, I., Stevens, R.K., & Lewtas, J. (1996). **Teplice program—the impact of air pollution on human health.** *Environ Health Perspect* 104 (Suppl 4):699-714.

Stem, B.R., Raizenne, M.E., Burnett, R.T., Jones, L, Kearney, J., & Franklin, C.A. (1994). **Air pollution and childhood respiratory health: exposure to sulfate and ozone in 10 Canadian rural communities.** *Environ Res* 66(2):125-42.

Tatotschenko, W.K, & Nesterenko, S.W. (1990). **[Effect of moderate pollutant concentrations in the air and incidence of respiratory diseases in children].** *Z Erkr Atmungsorgane* 174(3):185-9.

Wang, X., Ding, H., Ryan, L., & Xu, X. (1997). **Association between air pollution and low birth weight: a community-based study.** *Environmental Health Perspectives* 105(5):514-520.

Wichmann, H.E., & Heinrich, J. (1995). **Health effects of high level exposure to traditional pollutants in East Germany—review and ongoing research.** *Environ Health Perspect* 103 (Suppl 2):29-35.

Xu, X., Dockery, D.W., Christiani, D.C., Li, B., & Huang, H. (1995). **Association of air pollution with hospital outpatient visits in Beijing.** *Arch Environ Health* 50(3):214-20.

Xu, X., Ding, H., & Wang, X. (1995). **Acute effects of total suspended particles and sulfur dioxides on preterm delivery: a community-based cohort study.** *Arch Environ Health* 50(6):407-15.

REVIEWS

(1990). **Indoor air pollution in developing countries [editorial] [see comments].** *Lancet* 336(8730):1548.

(199 1). **Indoor air pollution in developing countries [letter; comment].** *Lancet* 337(8737):358-9.

Albalak, R. (1997). **Cultural practices and exposure to particulate pollutionfrom indoor biomass cooking: effects on respiratory health and nutritional status among the Aymara Indians of the Bolivian Highlands.** Unpublished Doctoral dissertation, University of Michigan.

Aunan, K (1996). **Exposure-response functions for health effects of air pollutants based on epidemiological findings.** *Risk Anal* 16(5):693-709.

Bates, D.V. (1995). **The effects of air pollution on children.** *Environ Health Perspect* 103 (Suppl 6):49-53.

Berman, S. (1991). **Epidemiology of acute respiratory infections in children of developing countries.** *Rev Infect Dis* 13 (Suppl 6):S454-62.

Boleij, J.S., & Brunekreef, B. (1989). **Domestic pollution as a factor causing respiratory health effects.** *Chest* 96(3 Suppl):368S-372S.

Chalise, S., Davidson, M., & Desowitz, R. (1985). **Domestic smoke pollution and respiratory illness in developing countries: Communique to the international medical and public health communities** (Unpublished). Honolulu, Hawaii: East-West Center.

Chen, B.H., Hong, C.J., Pandey, M.R., & Smith, K.R. (1990). **Indoor air pollution in developing countries.** *World Health Stat Q* 43(3):127-38.

de Koning, H.W., Smith, K.R., & Last, J.M. (1985). **Biomass fuel combustion and health.** *Bull World Health Organ* 63(1):11-26.

de Koning, H. (1987). **Rural energy and health of children.** *Adv Int Mat & Child Health* 7:130-137.

Douglas, R., & Kerby-Eaton, E. (1985). **Acute Respiratory Infections in Childhood. Sydney:** Department of Community Medicine, University of Adelaide.

Florig, H. (1997). **China's air pollution risks.** *Environmental Science & Technology* 31(6):274A-279A.

Garcia-Marcos, L., Guillen Perez, J. J., Niguez, J. C., & Guillen Marco, A. (1993). **[Air pollution and respiratory disease in children. Experience in Cartagena].** *An Esp Pediatr* 39 (Suppl 55):83-5. [Spanish]

Garenne, M., Ronsmans, C., & Campbell, H. (1992). **The magnitude of mortality from acute respiratory infections in children under 5 years in developing countries.** *World Health Stat Q* 45(2-3):180-9 1.

Graham, N.M. (1990). **The epidemiology of acute respiratory infections in children and adults: a global perspective.** *Epidemiol Rev* 12:149-78.

Han, C.Y. (1997). **Power, Priorities, and Public Health: A Study of Acute Respiratory Infections and Public Health Intervention in Kenya.** Unpublished Bachelor of Arts, Princeton University, Princeton, New Jersey.

Henry, C.J., Fishbein, L., Meggs, W.J., Ashford, N.A., Schulte, P.A., Anderson, H., Osborne, J.S., & Sepkovic, D.W. (1991). **Approaches for assessing health risks from complex mixtures in indoor air: a panel overview.** *Environ Health Perspect* 95:135-43.

Honicky, R.E., & Osborne, J.S.d. (1991). **Respiratory effects of wood heat: clinical observations and epidemiologic assessment.** *Environ Health Perspect* 95:105-9.

Jedrychowski, W. (1995). **Review of recent studies from central and Eastern Europe associating respiratory health effects with high levels of exposure to "traditional" air pollutants.** *Environ Health Perspect* 103 (Suppl 2):15-21.

Jones, H. (1974). **COPD in Women in Developing Countries.** *Chest* 65(6):704.

Kirkwood, B.R., Gove, S., Rogers, S., Lob-Levyt, J., Arthur, P., & Campbell, H. (1995). **Potential interventions for the prevention of childhood pneumonia in developing countries: a systematic review.** *Bull World Health Organ* 73(6):793-8.

Koenig, J.Q. (1988). **Indoor and outdoor pollutants and the upper respiratory tract.** *J Allergy Clin Immunol* 81(5 Pt 2):1055-9.

Koltai, P.J. (1994). **Effects of air pollution on the upper respiratory tract of children.** *Otolaryngol Head Neck Surg* 111(1):9-11.

Larson, T.V., & Koenig, J.Q. (1994). **Wood smoke: emissions and noncancer respiratory effects.** *Annu Rev Public Health* 15:133-56.

Leigh, M.W., Carson, J.L, & Denny, F.W., Jr. (1991). **Pathogenesis of respiratory infections due to influenza virus: implications for developing countries.** *Rev Infect Dis* 13 (Suppl 6):S501-8.

Marbury, M. (1991). **Wood smoke.** In J. Samet & J. Spengler (Eds.), *Indoor Air Pollution: A Health Perspective* (pp. 209-222). Baltimore and London: The Johns Hopkins University Press.

Martin, K. (1991). **Indoor air pollution in developing countries.** *The Lancet* 337:358.

Mishra, S., & Chaturvedi, P. (1995). **Acute respiratory infections with special reference to pneumonia in underfives.** *J Indian Med Assoc* 93(9):351-5.

Monto, A. (1990). **Acute respiratory infection in children in developing countries: challenge of the 90's.** *Review of Infectious Diseases* 11:498-505.

Murray, J.F., & Enarson, D.A. (1992). **World lung health: a concept that should become a reality. The ATS Committee on World Lung Health [editorial] [published erratum appears in Am Rev Respir Dis 1993 Mar;147(3):following 7831.** *Am Rev Respir Dis* 146(4):818-22.

Narain, J.P. (1987). **Epidemiology of acute respiratory infections.** *Indian J Pediatr* 54(2):15 3-60.

Ostro, B. (1993). **The association of air pollution and mortality: examining the case for inference.** *Arch Environ Health* 48(5):336-42.

Pandey, M., Neapane, R., & Gautam, A. (1987). **Domestic smoke pollution and acute respiratory infection in Nepal.** Paper presented at the Indoor Air '87: Proceedings of the 4th International Conference on Indoor Air Quality and Climate, 17-21 August, Berlin (West).

Pandey, M.R., Boleij, J.S., Smith, K.R., & Wafula, E.M. (1989). **Indoor air pollution in developing countries and acute respiratory infection in children.** *Lancet* 1(8635):427-9.

Pandey, M. (1997). **Women, wood energy and health.** *Wood Energy News* 12(l):3-5.

Pierson, W.E., Koenig, J.Q., & Bardana, E.J., Jr. (1989). **Potential adverse health effects of wood smoke.** *West J Med* 151(3):339-42.

Pope, C.A., 3rd, Bates, D.V., & Raizenne, M.E. (1995). **Health effects of particulate air pollution: time for reassessment?** *Environ Health Perspect* 103(5):472-80.

Pope, C.A., 3rd. (1996). **Particulate pollution and health: a review of the Utah valley experience.** *J Expo Anal Environ Epidemiol* 6(l):23-34.

Ramakrishna, J., & Joshi, V. (1995). **A framework for addressing health concerns related to cookstoves.** *Energy for Sustainable Development* 1(6):33-37.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1987). **Health effects and sources of indoor air pollution. Part 1.** *Am Rev Respir Dis* 136(6):1486-508.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1987). **Respiratory effects of indoor air pollution.** *J Allergy Clin Immunol* 79(5):685-700.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1988). **Health effects and sources of indoor air pollution. Part H.** *Am Rev Respir Dis* 137(l):221-42.

Samet, J.M., & Speizer, F.E. (1993). **Assessment of health effects in epidemiologic studies of air pollution.** *Environ Health Perspect* 101 (Suppl 4):149-54.

Samet, J.M., Smith, K.R., & Romeiu, I. (1997). **Air Pollution and ARI: a Review.** In B. Kirkwood, et al. (Eds.), *Interventions to Reduce Morbidity and Mortalityftom Pneumonia in Children.* London: London School of Hygiene and Tropical Medicine (forthcoming).

Sehgal, S. (1993). **Pneumocystis pneumonia: a time to shed complacence [editorial; comment].** *J Assoc Physicians India* 41(1):5-7.

Selgrade, M., & Gilmour, M. (1994). **Effects of gaseous air pollutants on immune responses and susceptibility to infectious and allergic disease.** In J. Dean, M. Luster, A. Munson, & 1. Kimber (Eds.), *Immunotoxicology and Immunopharmacology* (Second ed., pp. 395-411). New York: Raven Press, Ltd.

Smith, K.R. (1987). **Biofuels, air pollution, and health: a global review.** New York: Plenum Press.

Smith, K. (1990). **Health effects in developing countries.** In J. Paszter & L. Kristoferson (Eds.), *Bioenergy and Environment* (pp. 301-322). Boulder, CO: Westview.

Smith, K, ed., (1992). **Epidemiological, Social and Technical Aspects of Air Pollution from Biomass Fuel (Report** of a WHO Consultation VVHO/PEP/92.3A). Geneva: World Health Organization.

Smith, K. (1993). **Fuel combustion, air pollution exposure, and health: the situation in developing countries.** *Ann Environ Energy* 18:529-566.

Smith, K. (1994). **The health impact of cookstove smoke in Africa.** In H. Research Group on Airican Development Perspectives Bremen: Bass, J. Franz, E. Grawert, W. Hein, R. Kappel, F. Messner, J. Pohlan, & K. WohImuth (Eds.), *African Development Perspectives Yeabook 1992-1993: Energy and Sustainable Development (Vol. 3, pp. 417-434).* Hamburg: Lit Verlag.

Smith, K *(1996).* **Indoor air pollution in developing countries: growing evidence of its role in the global burden of disease.** In K. Ikeda & T. Iwata (Eds.), *Indoor Air '96: The 7th International Conference on Indoor Air Quality and Climate* (Vol. 3, pp. 33-44). Tokyo: Institute of Public Health.

Sram, R.J., Benes, I., Binkova, B., Dejmek, J., Horstman, D., Kotesovec, F., Otto, D., Perreault, S.D., Rubes, J., Selevan, S.G., Skalik, I., Stevens, R.K., & Lewtas, J. (1996). **Teplice program—the impact of air pollution on human health.** *Environ Health Perspect* 104 (Suppl 4):699-714.

Stansfield, S., & Shepard, D. (1993). **Acute respiratory infection.** In D. Jameson, W. Mosley, A. Measharn, & J. Bobadilla (Eds.), *Disease Control Priorities in Developing Countries* (pp. 67-90): Oxford University Press.

Sterling, T.D., Rosenbaum, W.L., & Weinkam, J.J. (1995). Re: **"Concentration of indoor particulate matter as a determinant of respiratory health.in children" [letter; comment].** *Am J Epidemiol* 141(6):581-2.

Terblanche, P., Nel, R., & Golding, T. (1994). **Household energy sources in South Africa - an overview of the impact of air pollution on human health.** Pretoria: CSIR Environmental Services, Department of Mineral and Energy Affairs and EMSA (Pty) Ltd.

Utell, M.J., & Samet, J.M. (1993). **Particulate air pollution and health. New evidence on an old problem [editorial; comment].** *Am Rev Respir Dis* 147(6 Pt 1):1334-5.

van Ginneken, J. (1989). **Behavioral factors affecting transmission and treatment of acute respiratory infections.** In J. Caldwell, S. Findley, P. Caldwell, G. Santow, W. Cosford, J. Braid, & D. Broers-Freeman (Eds.), *What We Know about Health Transition: The Cultural, Social and Behavioral Determinants of Health* (Vol. 2, pp. 843-865). Canberra.

von Schirnding, Y.E. (1992). **Environmental health issues in the 1990s [editorial].** *S Afr Med J* 81(11):536-7.

Wichmann, H.E., & Heinrich, J. (1995). **Health effects of high level exposure to traditional pollutants in East Germany—review and ongoing research.** *Environ Health Perspect* 103 (Suppl 2):29-35.

SUB-SAHARAN AFRICA

Chen, B.H., Hong, C.J., Pandey, M.R., & Smith, K.R. (1990). **Indoor air pollution in developing countries.** *World Health Stat Q* 43(3):127-38.

Smith, K. (1994). **The health impact of cookstove smoke in Africa.** In H. Research Group on African Development Perspectives Bremen: Bass, J. Franz, E. Grawert, W. Hein, R. Kappel, F. Messner, J. Pohlan, & K. Wohlmuth (Eds.), *African Development Perspectives Yeabook 1992-1993: Energy and Sustainable Development* (Vol. 3, pp. 417-434). Hamburg: Lit Verlag.

EAST AFRICA

Han, C.Y. (1997). **Power, Priorities, and Public Health: A Study of Acute Respiratory Infections and Public Health Intervention in Kenya.** Unpublished Bachelor of Arts, Princeton University, Princeton, New Jersey.

Mtango, F.D., Neuvians, D., Broome, C.V., Hightower, A.W., & Pio, A. (1992). **Risk factors for deaths in children under 5 years old in Bagamoyo district, Tanzania.** *Trop Med Parasitol* 43(4):229-33.

Wafula, E.M., Onyango, F.E., Thairu, H., Boleij, J.S., Hoek, F., Ruigewaard, P., Kagwanja, S., De Koning, H., Pio, A., Kimani, E., & et al. (1990). **Indoor air pollution in a Kenyan village.** *East Aft Med J* 67(l):24-32.

WHO. (1987). **Indoor air pollution study: Maragua, Kenya** (WHO/PEP/87.1). Geneva: World Health Organization.

SOUTHERN/CENTRAL AFRICA

Collings, D.A., Sithole, S.D., & Martin, K.S. (1990). **Indoor woodsmoke pollution causing lower respiratory disease in children.** *Trop Doct* 20(4):151-5.

Ellegard, A. (1996). **Cooking fuel smoke and respiratory symptoms among women in low-income areas in Maputo.** *Environ Health Perspect* 104(9):980-5.

Grobbelaar, J.P., & Bateman, E.D. (1991). **Hut lung: a domestically acquired pneurnoconiosis of mixed aetiology in rural women [published erratum appears in Thorax 1991 Jul;46(7):5441.** *Thorax* 46(5):334-40.

Kossove, D. (1982). **Smoke-filled rooms and lower respiratory disease in infants.** *S Afr Med J* 61(17):622-4.

Martin, K. (1991). **Indoor air pollution in developing countries.** *The Lancet* 337:358.

Terblanche, A.P., Opperman, L., Nel, C.M., Reinach, S.G., Tosen, G., & Cadman, A. (1992). **Preliminary results of exposure measurements and health effects of the Vaal Triangle Air Pollution Health Study.** *S Afr Med J* 81(11):5506.

Terblanche, P., Nel, R., & Golding, T. (1994). **Household energy sources in South Africa - an overview of the impact of air pollution on human health.** Pretoria: CSIR Environmental Services, Department of Mineral and Energy Affairs and EMSA (Pty) Ltd.

Wesley, A.G., & Loening, W.E. (1996). **Assessment and 2-year follow-up of some factors associated with severity of respiratory infections in early childhood.** *S Afr Med J* 86(4):365-8.

von Schirnding, Y.E. (1992). **Environmental health issues in the 1990s [editorial].** *S Afr Med J* 81(11):536-7.

Zwi, S., Davies, J.C., Becklake, M.R., Goldman, H.L, Reinach, S.G., & Kallenbach, J.M. (1990). **Respiratory health status of children in the eastern Transvaal highveld.** *S Afr Med J* 78(11):647-53.

WEST AFRICA

Armstrong, J.R., & Campbell, H. (1991). **Indoor air pollution exposure and lower respiratory infections in young Gambian children.** *Int J Epidentiol* 20(2):424-9.

Boleij, J.S., & Brunekreef, B. (1989). **Domestic pollution as a factor causing respiratory health effects.** *Chest* 96(3 Suppl):368S-372S.

Campbell, H. (1997). **Indoor air pollution and acute lower respiratory infections in young Gambian children.** *Health Bull (Edinb)* 55(l):20-31.

de Francisco, A., Morris, J., Hall, A.J., Armstrong Schellenberg, J.R., & Greenwood, B.M. (1993). **Risk factors for mortality from acute lower respiratory tract infections in young Gambian children** [see comments]. *Int J Epidemiol* 22(6):1174-82.

Femi-Pearse, D., Adeniyi-Jones, A., & Oke, a. (1973). **Respiratory symptoms and their relationship to cigarettesmoking, dusty occupations and domestic air pollution: studies in random sample of an urban African population.** *West Afr Med J Niger Med Dent Pract* 22(3):57-63.

Johnson, A.W., & Aderele, W.I. (1992). **The association of household pollutants and socio-economic risk factors with the short-term outcome of acute lower respiratory infections in hospitalized pre-school Nigerian children.** *Ann Trop Paediatr* 12(4):421-32.

0. Dempsey, T., McArdle, T.F., Morris, J., Lloyd-Evans, N., BaIdeh, I., Laurence, B.E., Secka, O., & Greenwood, B.M. (1996). **A study of risk factors for pneumococcal disease among children in a rural area of west Africa.** *Int J Epidemiol* 25(4):885-93.

Sofoluwe, G.O. (1968). **Smoke pollution in dwellings of infants with bronchopneumonia.** *Arch Environ Health* 16(5):670-2.

AUTHOR INDEX

(1990). **Indoor air pollution in developing countries [editorial] [see comments].** *Lancet* 336(8730):1548.

(1991). **Indoor air pollution in developing countries [letter; comment].** *Lancet* 337(8737):358-9.

(1993). **American Academy of Pediatrics Committee on Environmental Health: Ambient air pollution: respiratory hazards to children.** *Pediatrics* 91(6):1210-3.

Albalak, R. (1997). ***Culturalpractices and exposure to particulate pollution from indoor biomass cooking: effects on respiratory health and nutritional status among the Aymara Indians of the Bolivian Highlands.*** Unpublished Doctoral dissertation, University of Michigan.

Aldous, M. B., Holberg, C. J., Wright, A. L., Martinez, F. D., & Taussig, L. M. (1996). **Evaporative cooling and other home factors and lower respiratory tract illness during the first year of life. Group Health Medical Associates.** *Am JEpidemiol* 143(5):423-30.

Lower respiratory tract illness (LRI) is associated with exposure to various environmental factors. The relation between home environment and LRI in infants was studied with the use of data from the Children's Respiratory Study in Tucson, Arizona. Healthy infants from a health maintenance organization were recruited at birth (1980-1984). Analysis was restricted to one infant per family, and to those followed through the first year (n=936). Environmental data were collected at enrollment, and clinicians diagnosed LRI according to predetermined criteria. During the first year of life, 196 infants (21 %) had wheezing LRI, and 60 (6%) had nonwheezing LRI. The risk of wheezing LRI was higher in infants with evaporative home cooling (24%) than in those without evaporative home cooling (15%) (odds ratio = 1.8, 95% confidence interval 1.1-3.0); this association was stronger among infants who lived with other children in the home. The risk of nonwheezing LRI was associated with parents' rating of neighborhood dustiness, ranging from 5% in the least dusty environments to 12% in the dustiest (p for trend = 0.002). Neither association could be explained by confounding factors. LRI was not related to the type of home heating, cooking fuel, or the numbers of indoor dogs or cats.

Anderson, H. R. (1978). **Respiratory abnormalities in Papua New Guinea children: the effects of locality and domestic wood smoke pollution.** *Int J Epidentiol* 7(l):63-72.

Anderson, H. R. (1979). **Chronic lung disease in the Papua New Guinea Highlands.** *Thorax* 34(5):647-53.

In the Eastern Highlands of Papua New Guinea 46 men and 24 women with chronic lung disease underwent clinical and lung function investigations. In all cases the sole or predominant abnormality was irreversible airways obstruction, probably from chronic bronchitis with variable amounts of acompanying emphysema. There were close similarities to chronic obstructife lung disease in European populations in terms of symptoms, airways obstruction, transfer factor, and radiographic emphysema and inflammatory changes. Bronchiectasis and local fibrosis were present in a few subjects, but previous reports that puhnonary and pleural fibrosis are features of the disease were not confirmed. Possibly environmental and genetic factors may increase the associated blood gas disturbances leading to pulmonary hypertension. Unlike chronic obstructive lung disease in European populations, tobacco smoking is not an important aetiological factor. Although there is no direct evidence, the most likely possibilities are domestic wood smoke and acute chest infections.

Anderson, H. R. (1979). **Respiratory abnormalities, smoking habits and ventilatory capacity in a highland community in Papua New Guinea: prevalence and effect on mortality.** *Int J Epidemiol* 8(2):127-35.

The prevalence of chronic lung disease was investigated in 1284 adult residents of 11 villages situated at 1800 in in the Highlands of Papua New Guinea. Chronic cough, shortness of breath on exertion, bronchial hypersecretion, and adventitious chest sounds were increasingly common in both sexes from middle life onwards, and were associated with an irreversible obstructive ventilatory defect. Over the age of 45 years, 20% of men and 10% of women had an FEVl/FVC % less than 60%. The prevalence of active asthma was 0.25%. The smoking of home-grown, air-cured tobacco was not associated with chronic respiratory symptoms or reduction of ventilatory capacity. Smoking was, however, associated with recent cough symptom, bronchial hypersecretion and adventitiae. Mortality over the subsequent 5 years was increased 2-3 fold in those with adventitiae, but was not related to smoking status. The aetiological relevance of wood smoke in the houses and acute chest infections remains to be clarified.

Armstrong, J. R., & Campbell, H. (199 1). **Indoor air pollution exposure and lower respiratory infections in young Gambian children.** *Int J Epidentiol* 20(2):424-9.

In a rural population-based cohort study of approximately 500 Gambian children under five years old followed for one year, incidence of acute lower respiratory infections (ALR) was related to various risk factors including parental smoking and regular carriage on the mother's back while cooking, a proxy measure for exposure to smoke from cooking fires. Two statistical analyses using achild-weeks at risle approach were carried out, including and excluding multiple disease episodes in the same child. Weekly surveillance for ALRI found 75 episodes in 62 children. Stratified analyses using both approaches suggested father's smoking, and, for girls only, carriage on the mother's back while cooking and being part of a polygamous family were the main risk factors associated with infection: when multiple episodes occurring in the same child were excluded, not having a health card was an additional risk factor in children over a year old. Multiple logistic regression modelling of data from both approaches, including each of these risk factors and sex, age, village and season, suggested father's smoking, carriage on the mother's back while cooking and being part of a polygamous family increase risk of ALRI, the latter two for girls only The analysis excluding multiple episodes in the same child also suggested that not having a health card is a risk factor for children aged 1-5 years. The difficulties in interpreting these findings are discussed.

Aunan, K (1996). **Exposure-response functions for health effects of air pollutants based on epidemiological findings.** *Risk Anal* 16(5):693-709.

Quantitative knowledge about health damage due to air pollution is an important element in analyses of costeffective abatement strategies, and is also essential for setting Air Quality Standards. Epidemiological studies, in spite of the numerous problems connected to them, provide a reasonable basis for exposure-response functions in this context. On the basis of a literature review, exposure-response functions that relate ambient air pollutant concentrations to the frequency of various health effects are recommended in this paper. ne following end-points were examined: Acute and chronic respiratory symptoms in children and adults, crude mortality, and lung cancer incidence. The effects are attributed to one indicator component, which in most cases is particles. A calculation procedure is suggested which makes it possible to estimate excess annual symptom-days for short-term effects using the annual average concentration.

Awasthi, S., Glick, H.A., Fletcher, R.H., & Ahmed, N. (1996). **Ambient air pollution & respiratory symptoms complex in preschool children.** *Indian J Med Res* 104:257-62.

To study the association between ambient air pollutants (AAP) and respiratory symptoms complex (RSC) in preschool children, a cohort of 664 children between the ages of I month to 4.5 yr were randomly selected from 28 slums (anganwadi centres) of Lucknow, north India. They were followed up fortnightly for

six months. The outcomes assessed were presence of RSC at the time of interview and days on which symptoms had occurred in the past week. Exposure to ambient air sulphur dioxide (S02), oxides of nitrogen (NOx) and suspended particulate matter (SPM) on the day of the interview or in the week prior, was assessed by ambient air monitoring at 9 centres within the city. The cumulative incidence of RSC was 1.06 and the incidence density per 100 days of follow up was 1.63. All three pollutants were positively correlated with each other and negatively correlated with temperature. Ambient air SPM and S02 and cooking and heating fuels like dung cakes, wood, coal and kerosene and remaining indoors while the food was cooked were associated with increased incidence of RSC, increased duration of symptoms, or both. We conclude that to improve the respiratory health of preschool children, ambient air SPM and S02 levels should be kept as low as possible and mothers should be advised to keep children in another room while cooking.

Awasthi, S., Glick, H.A., & Fletcher, R.H. (1996). **Effect of cooking fuels on respiratory diseases in preschool children in Lucknow, India.** *Am J Trop Med Hyg* 55(l):48-51.

The association between cooking fuels and the risk of respiratory disease in preschool children in Lucknow, India was studied. We interviewed mothers of 650 study children, randomly selected from among 28 urban poor neighborhoods. Children were eligible if they were less than five years of age, free of congenital heart disease, malignancy, and compromised immune status. Respiratory disease (defined as one or more of the following: runny nose, cough, sore throat, breathlessness, and noisy respiration) was assessed by observation. Exposures included the types of cooking fuels and duration of their use in the last week and other potential predictors of respiratory disease. Odds ratios (ORs) for disease were adjusted for covariables using multiple logistic regression. The point prevalence of respiratory disease was 14.5%. Cooking fuels used were wood (56.0%), kerosene (24.2%), coal (19.2%), gas (15.4%), and dung cakes (8.6%). Use of dung cakes, a sun-dried mixture of cow or buffido dung and straw, as cooking fuel was associated with respiratory disease (adjusted OR = 2.69, 95% confidence interval [CII = 1.37-5.31, P = 0.004), as was overcrowding in the bedroom (adjusted OR = 1.25 for each additional person, 95% CI = 1.11-1.41, P = 0.001). Age, weight, gender, family income, and household structure were not associated with disease. Use of dung cakes as cooking fuel and overcrowding in the bedroom increased the risk of respiratory disease. Interventions to modify oven design or install chimneys and, where feasible, to reduce the number of people sleeping together should be considered.

Azizi, B.H., & Henry, R.L. (1990). Effects of **indoor air pollution on lung function of primary school children in Kuala Lumpur.** *Pediatr Pulmonol* 9(1):24-9.

In a cross-sectional study of 7-12 year-old primary school children in Kuala Lumpur city, lung function was assessed by spirometric and peak expiratory flow measurements. Spirometric and peak expiratory flow measurements were successfully performed in 1,214 and 1,414 children, respectively. As expected, the main predictors of forced vital capacity (FVC), forced expiratory volume in one second (FEV1), forced expiratory flow between 25% and 75% of vital capacity (FEF25-75), and peak expiratory flow rate (PEFR) were standing height, weight, age, and sex. In addition, lung function values of Chinese and Malays were generally higher than those of Indians. In multiple regression models which included host and environmental factors, asthma was associated with significant decreases in FEV I, FEF25-75, and PEFR. However, family history of chest illness, history of allergies, low paternal education, and hospitalization during the neonatal period were not independent predictors of lung function. Children sharing rooms with adult smokers had significantly lower levels of FEF25-75. Exposures to wood or kerosene stoves were, but to mosquito repellents were not, associated with decreased lung function.

Azizi, B.H., & Henry, R.L. (1991). **The effects of indoor environmental factors on respiratory illness in primary school children in Kuala Lumpur.** *Int J Epidemiol* 20(l):144-50.

The effects of indoor environmental factors on respiratory illness were studied in 15017-12 year old school children in Kuala Lumpur. Exposure to mosquito coil smoke for at least three nights a week was independently associated with asthma and persistent wheeze. Passive smoking, defined as sharing a bedroom with an adult smoker, was independently associated with a chest illness in the past year. No relationships were found between exposure to kerosene stoves, wood stoves, fumigation mat mosquito repellents or aerosol insecticides and respiratory illness. Host factors predictive of at least one respiratory outcome included family history of chest illness, history of allergy, male sex, hospitalization in the neonatal period and low paternal education. With 95% confidence, avoidance of regular exposure to mosquito coil smoke and passive smoking could reduce the prevalences of persistent wheeze, asthma and chest illness by up to 29%. Measurements of lung function confirmed the validity of questions pertaining to wheezing and asthma in the study questionnaire.

Azizi, B.H., Zulkifli, H.I., & Kasim, M.S. (1995). **Protective and risk factors for acute respiratory infections in hospitalized urban Malaysian children:** a **case control study.** *Southeast Asian J Trop Med Public Health* 26(2):280-5.

We performed a case control study to examine protective and risk factors for acute respiratory infections (ARI) in hospitalized children in Kuala Lumpur. Consecutive children between the ages of one month and five years hospitalized for pneumonia (n = 143), acute bronchiolitis (n = 92), acute laryngotracheobronchitis (n = 32) and empyema (n = 4) were included as cases and were compared with 322 children hospitalized during the same 24 hour period for non-respiratory causes. Potential risk and protective factors were initially analysed by univariate analysis. Logistic regression analysis confirmed that several home environmental factors were significantly associated with ARI. The presence of a coughing sibling (OR = 3.76, 95%CI 2.09, 6.77), a household with more than five members (OR = 1.52, 95%CI 1.03, 2.19) and sleeping with three other persons (OR = 1.45, 95%Cl 1.00, 2.08) were independent risk factors. Significant host factors were history of allergy (OR = 2.50, 95%CI 1.74, 3.6 1) and ethnicity (Malay race) (OR = 2.07 95%C1, 1.27, 3.37). Breast feeding for at least one month was confirmed as an independent protective factor (OR = 0.5 8, 95 %CI 0.3 8, 0.86). However, the study was not able to demonstrate that domestic air pollution had an adverse effect. This study provides further evidence that home environmental factors, particularly those associated with crowding, may predispose to ARI and that breast feeding is an important protective factor.

Bates, D.V. (1995). **The effects of air pollution on children.** *Environ Health Perspect* 103 (Suppl 6):49-53.

Air pollutants have been documented to be associated with a wide variety of adverse health impacts in children. These include increases in mortality in very severe episodes; an increased risk of perineonatal. mortality in regions of higher pollution, and an increased general rate of mortality in children; increased acute respiratory disease morbidity; aggravation of asthma, as shown by increased hospital emergency visits or admissions as well as in longitudinal panel studies; increased prevalence of respiratory symptoms in children, and infectious episodes of longer duration; lowered lung function in children when pollutants increase; lowered lung function in more polluted regions; increased sickness rates as indicated by kindergarten and school absences; the adverse effects of inhaled lead from automobile exhaust. These impacts are especially severe when high levels of outdoor pollution (usually from uncontrolled coal burning) are combined with high levels of indoor pollution. In developed countries, where indoor pollution levels are lower, increasing traffic density and elevated N02 levels with secondary photochemical and fine of ARI mortality seems to be similar to the European experience. The age pattern is very marked. In absolute values, ARI mortality is highest in the neonatal period and decreases with age. In relative values, ARI mortality is highest in the postneonatal period. ARI, mainly pneumonia, accounts for about 18% of underlying causes of death in developing countries. Pneumonia and other ARI are frequent complications of measles and pertussis; ARI is also coninionly found after other infections and in association with severe malnutrition. Virtually no data are

available in developing countries to provide final estimates of the role of ARI in mortality of children aged under 5 years. However, the WHO figure of I out of 3 deaths due to—or associated with—ARI may be close to the real range of the ARI-proportional mortality in children of developing countries. Results are discussed in light of the definitions of ARI used in various studies, the difficulties in ascertaining and coding multiple causes of death and the quality of data from some sources.

Behera, D., & Jindal, S.K. (1991). **Respiratory symptoms in Indian women using domestic cooking fuels.** *Chest* 100(2):385-8.

The effect of domestic cooking fuels producing various respiratory symptoms was studied in 3,701 women. Of these, 3,608 were nonsmoking women who used four different types of cooking fuels: biomass, LPG, kerosene, and mixed fuels. The overall respiratory symptoms were observed in 13 percent of patients. Mixed fuel users experienced more respiratory symptoms (16.7 percent), followed by biomass (12.6 percent), stove (11.4 percent), and LPG (9.9 percent). Chronic bronchitis in chulla users was significantly higher than that in kerosene and LPG users (p less than 0.05). Dyspnea and postnasal drip were significantly higher in the women using mixed fuels. Smoking women who are also exposed to cooking fuels experienced respiratory symptoms more often than nonsmokers (33.3 percent vs 13 percent).

Berman, S. (1991). **Epidemiology of acute respiratory infections in children of developing countries.** *Rev Infect Dis* 13 (Suppl 6):S454-62.

Acute respiratory infections cause four and a half million deaths among children every year, the overwhelming majority occurring in developing countries. Pneumonia unassociated with measles causes 70% of these deaths; post-measles pneumonia, 15%; pertussis, 10%; and bronchiolitis and croup syndromes, 5%. Both bacterial and viral pathogens are responsible for these deaths. The most important bacterial agents are Streptococcus pneumoniae, Haemophilus influenzae, and Staphylococcus aureus. The data on bacterial etiology of pneumonia during the first 3 months of life are limited, and almost no information on the role of chlamydia and pertussis in this age period is available. The distribution of viral pathogens in developing countries can be summarized as follows: respiratory syncytial virus, 15%-20%; parainfluenza viruses, 7%-10%; and influenza A and B viruses and adenovirus, 2%-4%. Mixed viral and bacterial infections occur frequently. Risk factors that increase the incidence and severity of lower respiratory infection in developing countries include large family size, lateness in the birth order, crowding, low birth weight, malnutrition, vitamin A deficiency, lack of breast feeding, pollution, and young age. Effective interventions for prevention and medical case management are urgently needed to save the lives of many children predisposed to severe disease.

Berwick, M. (1984). **Respiratory illness in children exposed to unvented combustion sources.** In B.B & L.T (Eds.), *Radon, passive smoking, particulates and housing epidemiology (pp.* 255-260). Stockholm, Sweden: Swedish Council for Building Research.

Bladen, W.A. (1983). **Relationship between acute respiratory illness and air pollution in an India industrial city.** *Journal of the Air Pollution Control Association* 33(3):226-7.

Boleij, J.S., & Brunekreef, B. (1989). **Domestic pollution as a factor causing respiratory health effects.** *Chest* 96(3 Suppl):368S-372S.

Boy, E., Rivera, J., & Delgado, H. (1992). **Study of Risk Factors for Low Birth Weight in Quetzaltenango:** Institute of Nutrition of Central America and Panama.

Braun-Fahrlander, C., Ackermann-Ilebrich, U., Schwartz, J., Gnehm, H.P., Rutishauser, M., & Wanner, H.U. (1992). Air **pollution and respiratory symptoms in preschool children.** *Am Rev Respir Dis* 145(1):42-7.

A diary study on a random sample of *625* Swiss children aged 0 to *5* yr was conducted in two cities in Switzerland to investigate the association between air pollution and respiratory symptoms. Total suspended particulates *(TSP), S02* and N02 were measured by city monitor. In addition, passive samplers inside and outside the home measured N02 concentration during the 6 wk each child was on the diary. Diaries were filled out by parents, and 20% were validated with the attending pediatrician's case notes. Incidence and duration of symptom episodes were examined separately. The study included any episode, episodes of coughing without runny nose, upper respiratory episodes, and episodes of breathing difficulty. In regressions using 6-wk average pollution that controlled for medical history, N02 measured outdoors but not indoors was associated with the duration of any symptom. Total suspended particulates were a more significant predictor of duration of any symptom than N02. The 6-wk average TSP was significantly associated with incidence of coughing episodes and marginally significant as a predictor of upper respiratory episodes. Previous day's TSP was a significant predictor of incidence of upper respiratory symptoms. Annual average of N02 was associated with the duration of any episode and of upper respiratory episodes. We conclude that the incidence and duration of respiratory symptom episodes are likely associated with particulate concentrations and duration may be associated with N02.

Browning, K.G., Koenig, J., Checkoway, H., Larson, T., Pierson, W.E. (1990). **A questionnaire study of respiratory health in areas of high and low ambient wood smoke pollution.** *Pediatric Asthma, Allergy & Immunology* 4(3):183-191.

Butterfield, P., Edmundson, E., LaCava, G., & Penner, J. (1989). **Woodstoves and indoor air: the effects on preschooler's upper respiratory systems.** *Journal of Environmental Health* 52(3):172-3.

Campbell, H., Armstrong, J.R., & Byass, P. (1989). **Indoor air pollution in developing countries and acute respiratory infection in children [letter].** *Lancet* 1(8645):1012.

Campbell, H. (1997). **Indoor air pollution and acute lower respiratory infections in young Gambian children.** *Health Bull (Edinb)* 55(1):20-31.

Chalise, S., Davidson, M., Desowitz, R., *et al.* (1985). **Domestic smoke pollution and respiratory illness in developing countries: Communique to the international medical and public health communities** (Unpublished). Honolulu, Hawaii: East-West Center.

Chen, B.H., Hong, C.J., Pandey, M.R., & Smith, K.R. (1990). **Indoor air pollution in developing countries.** *World Health Stat Q* 43(3):127-38.

Of the four principal categories of indoor pollution (combustion products, chemicals, radon and biologicals), research in developing countries has focused on combustion-generated pollutants, and principally those from solid-fuel-fired cooking and heating stoves. Such stoves are used in more than half the world's households and have been shown in many locations to produce high indoor concentrations of particulates, carbon monoxide and other combustion-related pollutants. Although the proportion of all such household stoves that are used in poorly ventilated situations is uncertain, the total population exposed to excessive concentrations is potentially high, probably several hundred million. A number of studies were carried out in the 1980s to discover the health effects of such stove exposures. The majority of such studies were done in South Asia in homes burning biomass fuels or in China with coal-buming homes, although a sprinkling of studies examining biomass-buming have been done in Oceania, Latin America and Africa. Of the health effects that might be expected from such exposures, little, if any, work seems to have been done on low

birthweight and eye problems, although there are anecdotal accounts making the connection. Decreased lung function has been noted in Nepali women reporting more time spent near the stove as it has for Chinese women using coal stoves as compared to those using gas stoves. Respiratory distress symptoms have been associated with use of smoky fuels in West India, Ladakh and in several Chinese studies among different age groups, some with large population samples. Acute respiratory infection in children, one of the chief causes of infant and childhood mortality, has been associated with Nepali household-smoke exposures. Studies of chronic disease endpoints are difficult because of the need to construct exposure histories over long periods. Nevertheless, chronic obstructive lung disease has been associated with the daily time spent near the stove for Nepali women and found to be elevated among coal-stove users compared to gas-stove users in Shanghai. In contrast to early reports, there seems to be little or no risk of nasopharyngeal cancer from cookstove smoke. Several studies in China, however, have found smoke to be a strong risk factor for lung cancer among non-smoking women. In addition, severe fluorosis has been observed in several parts of China where coal fluoride levels are high.(ABSTRACT TRUNCATED AT 250 WORDS)

Colley, J.R., Douglas, J.W., & Reid, D.D. (1973). **Respiratory disease in young adults: influence of early childhood lower respiratory tract illness, social class, air pollution, and smoking.** *Br Med J* 3(873):195-8.

Collings, D.A., Sithole, S.D., & Martin, K.S. (1990). **Indoor woodsmoke pollution causing lower respiratory disease in children.** *Trop Doct* 20(4):151-5.

Suggested aetiological factors were evaluated in *244* consecutive children presenting with lower respiratory disease at Marondera Hospital, Zimbabwe. Data obtained from these children were compared with information obtained from *500* children seen at the local well baby clinic. There were no differences in the prevalence of malnutrition, breast feeding, overcrowding, poor housing conditions and poverty in these two groups of children. A significant association was identified between lower respiratory disease and exposure to atmospheric woodsmoke pollution in young children. Air sampling within the kitchens of *40* children revealed levels of atmospheric pollution far in excess of the WHO recommended exposure limit. Elevated carboxyhaemoglobin concentrations confirmed childhood smoke inhalation. We suggest that in many Third World communities a chen-dcal pneumonitis resulting from the inhalation of noxious constituents of woodsmoke predisposes to lower respiratory disease in children.

Corea-Villasenor, A., Matanoski, G., Breysee, P., & Bautista, L. (1992). **Charcoal smoke and acute respiratory infections in children.** *The Quarterly Newsletter of the Centerfor Indoor Air Research* 2(1):1-3.

Cui, J., & MacKay, R. (1993). **Effects of passive smoking on respiratory illness from birth to age eighteen months, in Shanghai, People's Republic of China.** *The Journal of Pediatrics* 123(4):553-8.

Daigler, G.E., Markello, S.J., & Cummings, K.M. (1991). **The effect of indoor air pollutants on otitis media and asthma in children.** *Laryngoscope* 101(3):293-6.

This case-control study investigated the possible association between home environmental air pollutants and their effect on otitis media and asthma in children. Patients with physician-diagnosed otitis (n = 125, *74%* response), with asthma (n = 137, *80%* response), and controls (n = 237, *72%* response) from a private pediatric practice seen between October *1986* and May *1987* were studied. A questionnaire inquired about housing characteristics (i.e., age, insulation, heating system) and sources of indoor air pollution such as cigarette smoking, use of woodburning stoves, household pets, etc. Analysis of the responses confirmed previous findings of significant relationships between maternal smoking (P = .021*)*, and the presence of pets (P =*.034)* and the occurrence of asthma. A newly reported relationship between exposure to woodbuming

stoves and the occurrence of otitis (P less than *.05)* was reported. This implicates yet another risk factor (wood burning) in the etiology of otitis media.

de Francisco, A., Morris, J., Hall, A.J., Armstrong Schellenberg, J.R., & Greenwood, B.M. (1993). **Risk factors for mortality from acute lower respiratory tract infections in young Gambian children [see comments].** *Int J Epidemiol* 22(6):1174-82.

A case-control study has been undertaken in a rural area of The Gambia to evaluate risk factors for death from acute lower respiratory tract infections (ALRI) in young children. On the basis of a post-mortern interview *129* children aged < *2* years were thought to have died from ALRI. These cases were each matched according to age, sex, ethnic group, time and place of death with a child who had died from a cause other than an ALRI and with two live control children. Cases and controls were well matched. Comparison of cases and live controls suggested that exposure to smoke during cooking, parental smoking and exclusive, prolonged breastfeeding were associated with an increased risk of death from ALRI whilst sharing a bed with siblings, use of antenatal and welfare clinics and immunization were associated with a reduced risk of death from ALRI. No associations were found between mortality from ALRI and maternal education and literacy, socioeconomic status or with the age of the mother. Comparison of children who died from causes other than ALRI with the live controls showed a similar pattern of associations and no significant differences were found in any of the risk factors studied between children whose deaths were attributed to ALRI and those whose death was attributed to another cause. Association of death with exposure to smoke during cooking was the strongest risk factor identified. This risk might be altered by reducing smoke exposure during cooking.

de Koning, H.W., Smith, K.R., & Last, J.M. (1985). **Biomass fuel combustion and health.** *Bull World Health Organ* 63(1):11-26.

de Koning, H. (1987). **Rural energy and health of children.** *Adv Int Mat & Child Health* 7:130-137.

Dennis, R.J., Maldonado, D., Norman, S., Baena, E., Castano, H., Martinez, G., & Velez, J.R. (1996). **Woodsmoke exposure and risk for obstructive airways disease among women.** *Chest* 109(3 Suppl):55S-56S.

Dennis, R.J., Maldonado, D., Norman, S., Baena, E., & Martinez, G. (1996). **Woodsmoke exposure and risk for obstructive airways disease among women.** *Chest* 109(1):115-9.

OBJECTIVE: To investigate if exposure to firewood smoke and other indoor pollutants is a potential risk factor for obstructive airways disease (OAD) among women in Bogota in whom cigarette smoking and other known risk factors may not be the most fi-equent. DESIGN AND SETTING: We conducted a hospital-based case-control study to identify risk factors for OAD among women in Bogota. An interview was conducted using a modified questionnaire recommended by the American Thoracic Society for epiden-tiologic studies. PATIENTS: We compared 104 OAD cases with 104 controls matched by hospital and frequency matched by age. ANALYSIS: The odds ratio (OR) was used as the basic statistic to evaluate risk. Multivariate analysis (MA) was conducted by the Mantel-Haenszel procedure and by logistic regression. MAIN RESULTS: Univariate analysis showed that tobacco use (OR = 2.22; $p < 0.01$), wood use for cooking (OR = 3.43; $p < 0.001$), passive smoking (OR = 2.05; $p = 0.01$), and gasoline use for cooking (OR = 0.52; $p = 0.02$) were associated with OAD. Trends for years of tobacco use and years of wood cooking were present ($p < 0.05$). After MA, variables remained significant except gasoline use. CONCLUSIONS: 'Ibis study showed that among elderly women of low socioeconomic status in Bogota, woodsmoke exposure is associated with the development of OAD and may help explain around 50% of all OAD cases. The role of

passive smoking remains to be clarified. This work may set the basis for interventional studies in similar settings.

Dhar, S., & Pathania, A. (1991). **Bronchitis due to biomass fuel burning in North India: "Guijjar Lung," an extreme effect.** *Seminars in Respiratory Medicine* 12(2):69-74.

Dimitriev, D.A. (1994). **[Effect of air pollution on respiration in children].** *Gig Sanit* (7):7-9.

Study of the respiratory system in children living in the town of Cheboksary showed the highest incidence of diseases of the respiratory tract in children living in the districts with the highest levels of atmospheric air pollution.

Dockery, D.W., Ware, J.H., Ferris, B.G., Jr., Speizer, F.E., Cook, N.R., & Herman, S.M. (1982). **Change in pulmonary function in children associated with air pollution episodes.** *J Air Pollut Control Assoc* 32(9):937-42.

Dockery, D.W., Speizer, F.E., Stram, D.O., Ware, J.H., Spengler, J.D., & Ferris, B.G., Jr. (1989). **Effects of inhalable particles on respiratory health of children.** *Am Rev Respir Dis* 139(3):587-94.

Results are presented from a second cross-sectional assessment of the association of air pollution with chronic respiratory health of children participating in the Six Cities Study of Air Pollution and Health. Air pollution measurements collected at quality-controlled monitoring stations included total suspended particulates (TSP), particulate matter less than 15 microns (PM 15) and 2.5 microns (PM2.5) aerodynamic diameter, fine fraction aerosol sulfate (FS04), S02, 03, and No2. Reported rates of chronic cough, bronchitis, and chest illness during the 1980-1981 school year were positively associated with all measures of particulate pollution (TSP, PM15, PM2.5, and FS04) and positively but less strongly associated with concentrations of two of the gases (S02 and N02). Frequency of earache also tended to be associated with particulate concentrations, but no associations were found with asthma, persistent wheeze, hay fever, or nonrespiratory illness. No associations were found between pollutant concentrations and any of the pulmonary function measures considered (FVC, FEV I, FEVO.75, and MMEF). Children with a history of wheeze or asthma had a much higher prevalence of respiratory symptoms, and there was some evidence that the association between air pollutant concentrations and symptom rates was stronger among children with these markers for hyperreactive airways. These data provide further evidence that rates of respiratory illnesses and symptoms are elevated among children living in cities with high particulate pollution. They also suggest that children with hyperreactive airways may be particularly susceptible to other respiratory symptoms when exposed to these pollutants.(ABSTRACT TRUNCATED AT 250 WORDS)

Dockery, D.W., & Brunekreef, B. (1996). **Longitudinal studies of air pollution effects on lung function.** *Am J Respir Crit Care Med* 154(6 Pt 2):S250-6.

Dockery, D.W., Cunningham, J., Damokosh, A.I., Neas, L.M., Spengler, J.D., Koutrakis, P., Ware, J.H., Raizenne, M., & Speizer, F.E. (1996). **Health effects of acid aerosols on North American children: respiratory symptoms.** *Environ Health Perspect* 104(5):500-5.

We examined the respiratory health effects of exposure to acidic air pollution among 13,369 white children 8 to 12 years old from 24 communities in the United States and Canada between 1988 and 1991. Each child's parent or guardian completed a questionnaire. Air quality and meteorology were measured in each community for a 1 -year period. We used a two-stage logistic regression model to analyze the data, adjusting for the potential confounding effects of sex, history of allergies, parental asthma, parental education, and current smoking in the home. Children living in the community with the highest levels of particle strong acidity were significantly more likely [odds ratio (OR) = 1.66; 95 % confidence interval (CI)

1. 11-2.481 to report at least one episode of bronchitis in the past year compared to children living in the least-polluted community. Fine particulate sulfate was also associated with higher reporting of bronchitis (OR = 1.65; 95% Cl 1.12-2.42). No other respiratory symptoms were significantly higher in association with any of the air pollutants of interest. No sensitive subgroups were identified. Reported bronchitis, but neither asthma, wheeze, cough, nor phlegm, were associated with levels of particle strong acidity for these children living in a nonurban environment.

Dodge, R. (1982). **The effects of indoor pollution on Arizona children.** *Arch Environ Health* 37(3):151-5.

The respiratory health of a large group of Arizona school children who have been exposed to indoor pollutants-tobacco smoke and home cooking fumes—is reported. A significant relationship was found between parental smoking and symptoms of cough, wheeze, and sputum production. Also, children in homes where gas cooking fuel was used had higher rates of cough than children in homes where electricity was used. No differences in pulmonary function or yearly lung growth rates occurred among subjects grouped by exposure to tobacco smoke or cooking fuel. Thus, parental smoking and home cooking fuel affected cross-sectional respiratory symptom rates in a large group of Arizona school children. Study of pulmonary function, however, revealed no lung function or lung growth effects during 4 yr of study.

Dossing, M., Khan, J., & al-Rabiah, F. (1994). **Risk factors for chronic obstructive lung disease in Saudi Arabia.** *Respir Med* 88(7):519-22.

Based on the clinical impression of a relatively high number of non smoking women with COPD at a tertiary care facility in Saudi Arabia, we performed a case-control study to reveal possible risk factors. Our hypothesis was that the extensive use of incense burners among Saudis was a risk factor of COPD. Fifty consecutive patients with COPD and *71* healthy controls were questioned about risk factors of COPD. As expected more COPD-men than control men were smokers. Very few women smoked. We found no difference in the use of incense burners between cases and controls. On the other hand, two-thirds of the COPD-women and only 1/20 of the control women had been exposed to indoor open fire for more than 20 yr ($P < 0.05$). Accordingly, indoor exposure to open fire of wood or biomass seems to be a risk factor of COPD among Saudi women.

Douglas, R., & Kerby-Eaton, E. (1985). **Acute Respiratory Infections in Childhood.** Sydney: Department of Community Medicine, University of Adelaide. [Proceedings of the August 1984 international workshop in Sydney, 194 pp.]

Ellegard, A. (1996). **Cooking fuel smoke and respiratory symptoms among women in low-income areas in Maputo.** *Environ Health Perspect* 104(9):980-5.

Ile association between exposure to air pollution from cooking fuels and health aspects was studied in Maputo. Mozambique. Almost 1200 randomly selected women residing in the suburbs of Maputo were interviewed and 218 were monitored for air pollution. The fuels most commonly used were wood, charcoal, electricity, and liquified petroleum gas (LPG). Wood users were exposed to significantly higher levels of particulate pollution during cooking time (1200 n-dcrograms/m3) than charcoal users (540 micrograms/m3) and users of modem fuels (LPG and electricity) (200-380 n-dcrograms/m3). Wood users were found to have significantly more cough symptoms than other groups. This association remained significant when controlling for a large number of environmental variables. There was no difference in cough symptoms between charcoal users and users of modem fuels. Other respiratory symptoms such as dyspnea, wheezing, and inhalation and exhalation difficulties were not associated with wood use. Reducing wood use would likely improve acute respiratory health effects in wood users and possibly improve the ambient air pollution conditions in Maputo. To reduce the health impact of wood smoke exposure, it appears that the least costly and quickest method would be to encourage charcoal use to a greater extent, although high carbon monoxide

levels would have to be addressed. Turning to modern fuels is beyond the means of most these households in the short term and could not be shown to be more effective.

Ferni-Pearse, D., Adeniyi-Jones, A., & Oke, a. (1973). **Respiratory symptoms and their relationship to cigarettesmoking, dusty occupations and domestic air pollution: studies in random sample of an urban African population.** *West Afr Med J Niger Med Dent Pract* 22(3):57-63.

Ferris, B.G., Jr., Dockery, D.W., Ware, J.H., Speizer, F.E., & Spiro, R.d. (1983). **The Six-City Study: examples of problems in analysis of the data.** *Environ Health Perspect* 52:115-23.

This paper presents some of the results from cross-sectional analyses and studies during air pollution alerts obtained as a part of the Six-City Study, a longitudinal study of the respiratory effects of air pollution. These analyses illustrate some of the limitations and uncertainties of epiderniologic studies. For example, an earlier report noted increased respiratory illness rates for children living in homes where gas was used for cooking. A later analysis did not confirm this. Reasons for this are explored by using different criteria and variables to be controlled for. The results illustrate that the strength of the association between cooking fuel and illness was sensitive to the definitions of the variables and the number of subjects and city cohorts. Similar examples are presented for illness rates for four respiratory diseases: asthma, bronchitis, illness before age 2 and illness last winter. These examples of cross-sectional analyses emphasize the ambiguities of studies of possible health effects of air pollution exposures close to the present ambient air quality standards.

Florig, H. (1997). **China's air pollution risks.** *Environmental Science & Technology* 31(6):274A-279A.

Fonseca, W., KIrkwood, B.R., Victora, C.G., Fuchs, S.R., Flores, J.A., & Misago, C. (1996). **Risk factors for childhood pneumonia among the urban poor in Fortaleza, Brazil: a case—control study.** *Bull World Health Organ* 74(2):199-208.

Reported are the results of a case-control study carried out between July 1989 and June 1990 in Fortaleza city, Ceara State, Brazil, to determine the factors that place young children living in urban slum conditions at increased risk of contracting pneumonia. Cases were 650 under-2-year-olds with a radiological diagnosis of pneumonia who were recruited at the main paediatric hospital in the city over a full calendar year. Age-matched controls were recruited from the neighbourhood where the cases lived. Cases and controls were compared with respect to a variety of sociodemographic, environmental, reproductive, nutritional, and morbidity factors, and a risk factor questionnaire was administered to the mother of each child or to the child's normal guardian. Cases and controls were also weighed and measured. Malnutrition was the most important risk factor for childhood pneumonia in the study population, with weight-for-age, height-for-age, and weight-for-height also being important risk factors. In view of the high prevalence of stunting in the study population, there is an urgent need to reduce the level of malnutrition as a priority. Attendance at a day care centre was also associated with a high odds ratio. In view of the growing numbers of children attending day care centres; in both developing and developed countries, it is essential that ways be identified to improve the design and management of such centres in order to minimize the risk of pneumonia. Increased risks of childhood pneumonia were also associated with low birth weight, nonbreast-feeding, crowding, high parity, and incomplete vaccination status, but not with socioeconomic status or environmental variables. Finally, children who had suffered from previous episodes of wheezing or been hospitalized for pneumonia had a greater than threefold increased risk of contracting the disease.

Garcia-Marcos, L, Guillen Perez, J.J., Niguez, J.C., & Guillen Marco, A. (1993). **[Air pollution and respiratory disease in children. Experience in Cartagena].** *An Esp Pediatr* 39 (Suppl 55):83-5. [Spanish]

Studies on air pollution (S02) and their influence on respiratory diseases in children conducted in Cartagena are reviewed and compared with those from other spanish cities. In Cartagena we find a weak

relation between S02 levels and number of children admitted to hospital for asthma attack. Indoor pollution is stressed, specially smoking of mother.

Gharaibeh, N.S. (1996). **Effects of indoor air pollution on lung function of primary school children in Jordan.** *Ann Trop Paediatr* 16(2):97-102.

Environmental exposure to tobacco smoke and contaminants from unvented cooking stoves has been linked to impaired pulmonary function and respiratory diseases. These risk factors exist to a greater extent in developing countries and, in the case of exposure to tobacco smoke, they are reported to be increasing. In this study, pulmonary function studies were performed on 1905 children in Jordan. The effect of exposure to these environmental factors on respiratory function was analyzed. A significant negathe impact was found with regard to environmental exposure to both passive smoking and wood and kerosene unvented cooking stoves. 'Me mean values of lung function in children exposed and not exposed to passive smoking were, respectively, FVC (Q: 1.29-1.49; FEVI (L): 1.2-1.4; FEF25-75 (US): 1.84-2.24; PEFR (US): 2.63.21, and to wood and kerosene were FVC (L): 1.02-1.32; FEVI (L): 0.91-1.25; FEF25-75 (US): 1.24-1.86; PEFR (US): 1.67-2.64. This is a major problem in developing countries because of the increasing incidence of smoking and the high exposure to pollution risk factors.

Goldstein, B.D. (1991). **Predicting the risk of indoor air pollutants.** *Toxicol Ind Health* 7(5-6):195-201.

Goren, A.I., Hellman, S., Brenner, S., Egoz, N., & Rishpon, S. (1990). **Prevalence of respiratory conditions among schoolchildren exposed to different levels of air pollutants in the Haifa Bay area, Israel.** *Environ Health Perspect* 89:225-31.

During spring 1984, 2334 second and 2000 fifth-grade schoolchildren living in three Haifa Bay areas on the eastern Mediterranean coast with different levels of air pollution were studied. The parents of these children filled out American Thoracic Society and National Heart and Lung Institute health questionnaires, and the children performed the following pulmonary function tests (PIFT); FVC, FEV 1, FEVI/FEV, PEF, FEF50, and FEF75. A trend of higher prevalence of most reported respiratory symptoms was found for schoolchildren growing up in the medium and high pollution areas as compared with the low pollution area. Part of the reported respiratory diseases were significantly more common among children from the high pollution area. Models fitted for the respiratory conditions that differed significantly among the three areas of residence also included background variables that could be responsible for these differences. Relative risk values, which were calculated from the logistic models, were in the range of 1.38 for sputum with cold and 1.81 for sputum without cold for children from the high pollution area as compared with 1.00 for children from the low pollution area. All the measured values of PFr were within the normal range. There was no consistent trend of reduced pulmonary function that characterized any residential area.

Goren, A.I., & Hellmann, S. (1995). **Respiratory conditions among schoolchildren and their relationship to environmental tobacco smoke and other combustion products.** *Arch Environ Health* 50(2):112-8.

The purpose of this study was to examine possible links between respiratory conditions among schoolchildren and exposure to envirom-nental tobacco smoke and other home and community exposures. More than 8,000 second- and fifthgrade schoolchildren who lived in three towns along the Israeli coast were administered pulmonary function tests, and their parents completed standardized health questionnaires. The prevalence of the most reported respiratory conditions was found to be higher, some of them significantly so, among children whose fathers or mothers were smokers, compared with children of non-smoking parents. Most respiratory conditions were reported significantly more often for children who were growing up in medium- and highly polluted communities than for children from low-polluted areas. House heating with kerosene or gas was seldom associated with higher prevalence of respiratory conditions among children. No consistent r trend of reduced pulmonary function tests was associated with exposure to environmental

tobacco smoke, with community pollution, or with house heating pollution. In conclusion, exposure of schoolchildren to their parents' cigarette smoke and to community air pollution is associated with higher prevalence of respiratory conditions, whereas house heating does not appear to be a public health problem in Israel.

Graham, N.M. (1990). **The epidemiology of acute respiratory infections in children and adults: a global perspective.** *Epidemiol Rev* 12:149-78.

While a number of advances have been made in our understanding of the epidemiology of acute respiratory infections in the past two decades, a number of serious questions still require urgent answers. The associations of factors such as chronic disease in adults, direct smoking, passive smoking, crowding, and breast feeding to acute respiratory infections are now well documented. Appropriate changes in public health policy need not be predicated on results from still further studies. However, in virtually all of the other areas cited in this review, further data are required. In developing countries, studies being currently conducted on vitamin A supplementation, malnutrition, and indoor air pollution will help address the most pressing issues. More studies are also needed on the relations between HIV infection and acute respiratory infections, as well as low birth weight and respiratory infection. The National Research Council studies have provided important additional data on etiologic agents in children in developing countries, but data on adult pneumonia remain sparse. In developed countries the issues that may be of greatest interest are the relation between maternal antibody levels and passive immunity in infants, the reasons for the increase in pneumonia mortality in older age groups, and the relation between air pollution and acute respiratory infections (as opposed to morbidity from bronchial reactivity). From a methodological viewpoint, the relation between previous respiratory infection (particularly in the first year of life) and subsequent acute respiratory infection morbidity has been inadequately explored. Adjustment for autocorrelation in multivariate models may be necessary if this relation is strong. Greater standardization of data collection methods in developed and developing countries also needs to be more seriously addressed. Given that some advances have been made in this area, the time may be right for development of acute symptom questionnaires, akin to the American Thoracic Society chronic respiratory questionnaire, for use in both developed and developing countries. Standardization of diaries, although somewhat more difficult, would also be extremely useful in many instances.

Grobbelaar, J.P., & Bateman, E.D. (1991). **Hut lung: a domestically acquired pneumoconiosis of mixed aetiology in rural women [published erraturn appears in Thorax 1991 Jul;46(7):544].** *Thorax* 46(5):334-40.

A form of pneumoconiosis in rural African women termed “Transkei silicosis” has been thought to be due to silica particles inhaled while they are hand grinding maize between rocks. Twenty five women were studied who were considered to have this condition according to the following criteria: rural domicile, radiographic and lung biopsy evidence of pneumoconiosis, no exposure to mining or industry and no evidence of active tuberculosis. They were assessed for radiological, pathological, physiological and bronchoalveolar lavage fluid features. Potential aetiological factors were assessed by determining levels of exposure to respirable quartz and non-quartz containing dusts and smoke in rural dwellings during maize grinding and cooking. Most of the women were symptomless. Radiological findings ranged from a mifiary pattern to extensive fibrosis resembling progressive massive fibrosis. Histological features included simple "anthracosis" in 12, anthracosis with macules in six, and mixed dust fibrosis in seven. Cell numbers and their proportions in lavage fluid were normal. More than 60% of macrophages were heavily laden with inorganic inclusions. Respirable quartz concentrations and calculated cumulative time weighted exposures were below those recommended for industry during grinding with sandstone (100% quartz) and they were even lower during grinding with dolerite containing no quartz despite the presence of an appreciable amount of quartz in the ground maize. Total respirable dust and smoke concentrations were greater than the recommended safe

levels. Three women had no exposure to maize grinding. It is concluded that the inhalation of nonquartz containing dust and smoke from biomass fuelled fires is more important in the aetiology of this condition than exposure to quartz dust. The term "hut lung" may be more appropriate.

Guha-Sapir, D. (1996). **Environment of urban poor communities in Asia: study on the effects of indoor air pollution among infants in Delhi and Manila** (Final Report (draft)). Brussels: Catholic University of Louvain, Department of Public Health.

Guneser, S., Atici, A., Alparslan, N., & Cinaz, P. (1994). **Effects of indoor environmental factors on respiratory systems of children.** *J Trop Pediatr* 40(2):114-6.

Effects of indoor environmental factors on children's respiratory system and pulmonary function tests were investigated in this study. A total of 617 primary school children aged between 9-12 years were included. A standard questionnaire, which includes questions about respiratory symptoms and illness, indoor environmental determinants, family history of respiratory diseases, and smoking habits of the parents, was sent to homes of all children and information was obtained from parents. Children with a family history of asthma, bronchitis, or other chest troubles suffered morning and day/night coughs, shortness of breath, wheezing and asthma, bronchitis, or pneumonia more frequently. Children whose mothers smoked complained of blocked-runny nose and sinusitis more frequently. Pulmonary function levels were diminished in passive smokers and in children whose houses were heated by a wood-burning stove. As a result, passive smoking, using a wood-burning stove for heating, and family history of respiratory diseases are to be considered risk factors for the respiratory system.

Han, C.Y. (1997). **Power, Priorities, and Public Health: A Study of Acute Respiratory Infections and Public Health Intervention in Kenya.** Unpublished Bachelor of Arts, Princeton University, Princeton, New Jersey.

He, Q.C., Lioy, P.J., Wilson, W.E., & Chapman, R.S. (1993). **Effects of air pollution on children's pulmonary function in urban and suburban areas of Wuhan, People's Republic of China.** *Arch Environ Health* 48(6):382-91.

In May and June of 1988, the spirometric lung function of 604 children, who were aged 7-13 y and who were free of chronic respiratory conditions, was measured in the urban core and a suburb of Wuhan, China. During 1981-1988, ambient total suspended particulate (TSP) levels averaged 481 micrograms/m3 in the urban core and 167 micrograms/m3 in the suburb. In 1988, TSP levels, measured within 500 in of the children's homes, averaged 251 micrograms/m3 in the urban core and 110 micrograms1m3 in the suburb. Levels of sulfur dioxide and nitrogen oxides were also higher in the urban core. Proportions of families who burned coal and gas domestically were similar in both areas. In linear and logarithmic regression models, height was a stronger determinant of forced vital capacity and forced expiratory volume in I s than was age or weight. In linear models, the proportion of variance explained by height (R-squared) ranged from 0.54 for urban females' forced expiratory volume in I s to 0.77 for suburban males and females. Both forced vital capacity and forced expiratory volume in 1 s were consistently lower in urban than suburban children. The average forced vital capacity and forced expiratory volume in I s in children 132-144 cm tall were 6.7% and 3.8% lower, respectively, in the urban core than the suburb; suburban-urban differences increased with height. Suburban-urban differences in slopes of lung function growth curves were statistically significant for forced vital capacity but not for forced expiratory volume in I s. Rates of clinical upper respiratory irritation were also generally elevated in urban children. These results strongly suggest that urban ambient air pollution exposure in China contributes to retardation in the growth of children's lung function. Confirmatory longitudinal studies are in progress in Wuhan and three other Chinese cities.

Helfenstein, U., Ackermann-Liebrich, U., Braun-Fahrlander, C., & Wanner, H.U. (1991). **The environmental accident at 'Schweizerhalle' and respiratory diseases in children:** a **time series analysis.** *StatMed* 10(10):1481-92.

During an investigation concerned with the relationship between air pollution and respiratory diseases in children, the 'Schweizerhalle' accident occurred when unknown amounts of pollutants were discharged into the environment. In that investigation, two series of medical data were collected during one year: (a) The daily relative number of preschool children, exhibiting diseases of the respiratory tract, who either came to the outpatients' clinic of the Children's Hospital or were reported by paediatricians in Basle; (b) The daily number of respiratory symptoms per child, observed in a group of randomly selected preschool children. The purpose of the present time series analysis is the assessment of possible change in these series after the environmental accident. The nature of the change is studied by complementary approaches. First, a forecast arising from models identified in the preaccident period is compared with the actual data. Thereafter, intervention models which adequately and parsimoniously represent the change are identified. Finally, an identification of a change-point is performed.

Henry, C.J., Fishbein, L., Meggs, W.J., Ashford, N.A., Schulte, P.A., Anderson, H., Osborne, J.S., & Sepkovic, D.W. (1991). **Approaches for assessing health risks from complex mixtures in indoor air: a panel overview.** *Environ Health Perspect* 95:135-43.

Critical to a more definitive human health assessment of the potential health risks from exposure to complex mixtures in indoor air is the need for a more definitive clinical measure and etiology of the health effects of complex mixtures. This panel overview highlights six of the eight presentations of the conference panel discussion and features a number of the major topical areas of indoor air concern. W. G. Meggs assessed clinical research priorities with primary focus on the role of volatile organic chemicals in human health, recognizing the areas where definitive data are lacking. By recognizing many types of chemical sensitivity, it may be possible to design studies that can illuminate the mechanisms by which chemical exposure may cause disease. The critically important topic of multiple chemical sensitivity was discussed by N. A. Ashford, who identified four high risk groups and defined the demographics of these groups. P. A. Schulte addressed the issue of biological markers of susceptibility with specific considerations of both methodological and societal aspects that may be operative in the ability to detect innate or inbome differences between individuals and populations. Three case studies were reviewed. H. Anderson discussed the past and present priorities from a public health perspective, focusing on those issues dealing with exposures to enviromnental tobacco smoke and formaldehyde off-gassing from materials used in mobile home construction. J. J. Osborne described several case studies involving wood smoke exposure to children, with emphasis on the significantly greater occurrence of chronic respiratory symptoms and acute chest illness for children from homes heated with woodburning stoves.

Herbarth, 0. (1995). **Risk assessment of environmentally influenced airway diseases based on time-series analysis.** *Environ Health Perspect* 103(9):852-6.

Threshold values are of prime importance in providing a sound basis for public health decisions. A key issue is determining threshold or maximum exposure values for pollutants and assessing their potential health risks. Environmental epidemiology could be instrumental in assessing these levels, especially since the assessment of ambient exposures involves relatively low concentrations of pollutants. This paper presents a statistical method that allows the determination of threshold values as well as the assessment of the associated risk using a retrospective, longitudinal study design with a prospective follow-up. Morbidity data were analyzed using the Fourier method, a time-series analysis that is based on the assumption of a high temporal resolution of the data. This method eliminates time-dependent responses like temporal inhomogeneity and pseudocorrelation. The frequency of calls for respiratory distress conditions to the regional Mobile Medical Emergency Service (MMES) in the city of Leipzig were investigated. The entire population of Leipzig served

as a pool for data collection. hi addition to the collection of morbidity data, air pollution measurements were taken every 30 min for the entire study period using sulfur dioxide as the regional indicator variable. This approach allowed the calculation of a dose-response curve for respiratory diseases and air pollution indices in children and adults. Significantly higher morbidities were observed above a 24-hr mean value of 0.6 mg SO2/m3 air for children and 0.8 mg SO2/m3 for adults.

Heumann, M., Foster, L., Johnson, L., & Kelly, W. (1991). **Woodsmoke air pollution and changes in pulmonary function among elementary school children.** Portland: Oregon Health Division, Office of Epidemiology.

Hoek, G., & Brunekreef, B. (1995). **Effect of photochemical air pollution on acute respiratory symptoms in children.** *Am J Respir Crit Care Med* 151(1):27-32.

In the spring and summer of 1989, an epiderniologic study of the acute effects of photochemical air pollution on the respiratory health of 300 children 7 to I I yr old was conducted. The children studied were a general.population sample of the children living in two rural towns in the Netherlands. For these children, small pulmonary function decrements associated with ambient ozone concentrations were reported previously. In this paper, the association between photochemical ambient air pollution and acute respiratory symptoms is evaluated. Occurrence of acute respiratory symptoms was registered by the parents of the children in a diary on a daily basis. The association of symptom prevalence and incidence with air pollution was evaluated using a logistic regression model that took auto-correlation of the residuals into account. Several photochemical episodes occurred in the study period of 102 d. Hourly maximum ozone concentrations ranged from 14 to 114 ppb. Daily average PM10 concentrations ranged from 11 to 136 micrograms/m3. Levels of acid aerosol were low. No associations of daily symptom prevalence or incidence with same-day or previous day concentration levels of ozone, PM10, fine particle sulfate, or nitrate were observed.

Hong, C. (1991). **Health aspects of domestic use of biomass and coal in China.** Geneva: WHO.

A paper prepared for the Informal Consultation on Epiderriiologic, Social, and Technical Aspects of Indoor Air Pollution from Biomass Fuels

Honicky, R. E., Akpom, C. A., & Osborne, J. S. (1983). **Infant respiratory illness and indoor air pollution from a woodburning stove.** *Pediatrics* 71(1):126-8.

Honicky, R.E., Osborne, J.S.d., & Akpom, C.A. (1985). **Symptoms of respiratory illness in young children and the use of wood-burning stoves for indoor heating.** *Pediatrics* 75(3):587-93.

The occurrence of symptoms of respiratory illness among preschool children living in homes heated by woodburning stoves was examined by conducting an historical prospective study (n = 62) with an internal control group (matched for age, sex, and town of residence). Exposures of subjects were not significantly different (P greater than .05) with respect to parental smoking, urea-formaldehyde foam insulation, and use of humidifiers. The control group made significantly greater use of gas stoves for cooking whereas the study group made greater use of electric stoves for cooking and of air filters (P less than .05). Only one home used a kerosene space heater. During the winter of 1982, moderate and severe symptoms in all categories were significantly greater for the study group compared with the control group (P less than .001). These differences could not be accounted for by medical histories (eg, allergies, asthma), demographic or socioeconomic characteristics, or by exposure to sources of indoor air pollution other than wood-burning stoves. Present findings suggest that indoor heating with wood-burning stoves may be a significant etiologic factor in the occurrence of symptoms of respiratory illness in young children.

Honicky, R.E., & Osborne, J.S.d. (1991). **Respiratory effects of wood heat: clinical observations and epidendologic assessment.** *Environ Health Perspect* 95:105-9.

An increasing number of families in the United States are converting to woodburning stoves in an effort to reduce winter heating bills. Woodburning stoves operate as a contained combuster of wood and produce a variety of pollutants as byproducts of combustion. Although technological advances have reduced emissions to some degree, even the most efficient woodburning stoves emit hazardous pollutants directly into the home when the stove is operating and the door is opened to add wood. The question arises as to whether pollutants are accumulating in homes where woodburning stoves are used as a source of heat. This issue is especially important considering the trend to increase home insulation and overall airtightness in an effort to conserve energy and reduce heat loss. Ibis paper reviews the clinical case report that first postulated an association of recurrent chest illness with woodburning stove exposure and summarizes the findings to date on respiratory effects of wood heat for young children.

Hu, H., & Liu, Y. (1989). **Evaluation of indoor air pollution and its effect on human health in Beijing's rural areas.** *Environment International* 15(1/6):321.

Jedrychowski, W. (1995). **Review of recent studies from central and Eastern Europe associating respiratory health effects with high levels of exposure to "traditional" air pollutants.** *Environ Health Perspect* 103 (Suppl 2):15-21.

The serious environmental problems caused by decades of Communist mismanagement of natural resources in countries of Central and Eastern Europe have been brought to light in recent years. All environmental media, including air, water, food, and soil have been burdened with toxic chemicals. Large segments of the population have been, and are now being exposed to air pollution levels exceeding guidelines established by western countries and by international health organizations. This review focuses on epiderniologic evidence regarding health effects of poor air quality in Central and Eastern Europe. It appears that short-term high levels of air pollutants (primarily particulates and S02) may increase mortality in sensitive parts of the population. Associations were also seen between air pollution levels and prevalence of respiratory diseases as well as lung function disturbances in adults and children. One study indicated that urban air pollution increased the risk of lung cancer. Several investigations pointed to strong interactions between risk factors. The poor scientific standard of the studies often makes it difficult to evaluate the findings. Several steps should be taken to develop environmental epidemiology in Central and Eastern Europe, including international collaboration in research projects and training.

Jedrychowski, W., Flak, E., & Mroz, E. (1995). **[Prospective epidemiologic study on respiratory diseases in children in Cracow. Pilot study].** *Przegl Epidemiol* 49(3):331-9.

After introducing the main purpose of the project on the outdoor and indoor air quality and children's health in Cracow, the paper presents the results of the pilot study carried out in the higher polluted city area (suspended particulate matter: 51.5-74.5 micrograms/m3/year; S02: 58.4-73.8 micrograms/m33/year) and in the less polluted area (suspended particulate matter: 31.7 rnicrograms/m3/year; S02: 36.1 microgranVm3/year). The pilot study covered 171 children. There was an excess of chronic respiratory symptoms in children from the higher polluted area, but only the frequency of shortness of breath in boys and attacks of shortness of breath with wheezing in girls were significantly higher in those living in the polluted area. Spirometric indices were significantly lower in both boys and girls in the residence area with the higher air pollution level. The data on prevalence of respiratory diseases in the pilot study will be used to estimate the size of the sample needed in the other stages of the prospective study.

Jedrychowski, W., Flak, E., & Mroz, E. (1996). **[Variability of respiratory system reactions to air pollutants. Epidemiologic study of children in Cracow].** *Pneumonol Alergol Pol* 64(5-6):267-75.

The main purpose of the study was to corroborate the hypothesis that the history of allergic skin reactions is the marker of individual susceptibility of respiratory tract to air pollutants in children. The study has been carried out in two contrast areas of the city regarding the air pollution level. In the dirty area the annual daily mean concentrations of particulate matter was 51.5-74.5 micrograms/m3 and sulfur dioxide 58.4-73.8 micrograms/m3; in the cleaner part of the city the corresponding concentrations were 31.7 and 36.1 micrograms/m3. The medical examination of 171 children covered standardized interviews with mothers and spirometric measurements. The results obtained showed that despite the marked decline in air pollution level, the current level of common air pollutants in the city is hazardous to the health of inhabitants. 'Me children with history of allergic skin reactions have been affected much stronger by the higher level of air pollutants than other children. Beside the higher frequency of chronic cough or phlegm, wheezing or shortness of breath, they had significantly poorer lung function measured by FEVI/FVC index.

Johnson, A.W., & Aderele, W.I. (1992). **The association of household pollutants and socio-economic risk factors with the short-term outcome of acute lower respiratory infections in hospitalized pre-school Nigerian children.** *Ann Trop Paediatr* 12(4):421-32.

In a 9-month study of acute lower respiratory infections (ALRI), the short-term prognostic implications of socioeconomic and household risk factors were examined in 103 hospitalized pre-school Nigerian children. Seventy-nine (77%) subjects were potentially exposed to the combustion products of kerosene stoves, 16 (16%) to wood smoke and five (5%) to the products of cooking gas combustion. Only 17 subjects (17%) were exposed to household cigarette smoke. A highly significant association ($p < 0.005$) was shown between household cooking fuel and the outcome of hospitalization: five (63%) of the eight who died were potentially exposed to wood smoke. The duration of hospitalization was only significantly associated with paternal income ($p < 0.05$). None of the other domestic risk factors was significantly related to outcome or duration of admission. These findings suggest an association between an adverse outcome of ALRI and domestic exposure to wood smoke. While the hospital-based source will not allow definite conclusions, the present findings underscore the need for community-based studies. The implications for future strategies of ARI control are discussed, with suggestions.

Jones, H. (1974). **COPD in Women in Developing Countries.** *Chest* 65(6):704.

Karpatova, E., Michalickova, J., & Prikazsky, V. (1993). **[Air pollution and the occurrence of recurrent respiratory tract diseases in children in the first years of life.** H]. *Cesk Pediatr* 48(6):354-9.

In 200 3-7-year-old children in two localities of Bratislava-city with different concentrations of N02, S02, dustiness with different bioclimatic factors and a different epidemiological position the authors investigated their effect on the frequency, incidence and types of relapsing respiratory diseases during different months in 1991. The different concentrations of the above substances in the atmosphere of the two localities did not affect the number of respiratory diseases nor their annual or monthly incidence. In the place with the increased N02 concentration a significantly higher number of serious fon-ris of respiratory diseases was found in the investigated group. In the locality with a more favourable oecological and epidemiological situation the adverse effect of monthly N02 concentrations was manifested when it was potentiated by the S02 concentration and combined with dustiness and dust fall-out. The authors found a significant correlation between the incidence of relapsing respiratory diseases and the atmospheric temperature and its relative humidity in the course of different months of the year.

Kim, P.E., Musher, D.M., Glezen, W.P., Rodriguez-Barradas, M.C., Nalun, W.K., & Wright, C.E. (1996). **Association of invasive pneumococcal disease with season, atmospheric conditions, air pollution, and the isolation of respiratory viruses.** *Clin Infect Dis* 22(1):100-6.

We examined the relation of invasive pneurnococcal disease to season, atmospheric conditions, and the rate of respiratory virus isolation in a community-wide surveillance program in Houston. Among adults, the number of cases of pneumococcal bacteremia peaked in midwinter and declined strikingly in midsummer, indicating a high degree of inverse corTelation with the ambient temperature. We detected significant correlations between the occurrence of pneumococcal disease and the isolation of respiratory syncytial virus ($P < .001$), influenza virus ($P < .001$), and all viruses except influenza virus ($P < .001$), as well as with air pollution, as measured by S02 levels ($P < .001$). In contrast, the rate of invasive pneumococcal disease among infants and children was relatively more sustained from October through May, with a notable decrease in surnmer months; the incidence of pneumococcal disease was therefore less strongly correlated with cold weather and less closely associated with the isolation of respiratory syncitial virus or influenza virus. However, pneurnococcal disease among infants and children was associated with isolation of these viruses after a 4-week lag period as well as with isolation of adenovirus and ragweed pollen counts. The finding, with regard to children, that correlations tended to be stronger for events that occurred I month previously than for those that occurred contemporaneously is consistent with the concept that viral or allergic events predispose to otitis media with effusion, which becomes suppurative and leads to prieurnococcal bacteremia or meningitis. For adults, a more immediate predisposition to pneumococcal pneumonia and bacteremia because of viral infection or air pollution was suggested.

Kirkwood, B.R., Gove, S., Rogers, S., Lob-Levyt, J., Arthur, P., & Campbell, H. (1995). **Potential interventions for the prevention of childhood pneumonia in developing countries:** a systematic review. *Bull World Health Organ* 73(6):793-8.

This article describes the background and framework for a systematic review of potential interventions for preventing pneumonia among under-5-year-olds in developing countries. Twenty-eight intervention areas are identified in six groups -immunization, case management/chemoprophylaxis of high-risk children, improving nutrition, reducing environmental pollution, reducing transmission of pathogens, and improving child care practices. Calculation of the potential impacts is illustrated and the expected outcomes are also described.

Koenig, J.Q. (1988). **Indoor and outdoor pollutants and the upper respiratory tract.** *J Allergy Clin Immunol* 81(5 Pt 2):1055-9.

The health effects of both indoor and outdoor air pollutants are of increasing concern. The health effects of outdoor air pollutants traditionally have been assessed through measurements of lower respiratory tract changes. However, it has been shown that one outdoor air pollutant sulfur dioxide, decreases nasal mucus flow and increases nasal airway resistance. Along with cigarette smoke, indoor air pollutants such as formaldehyde, cadmium, and ammonium or sulfate ions have been shown to alter upper airway mucociliary function. Emissions from wood stoves are known to irritate the upper airways. Measurement of nasal airway resistance using posterior rhinomanometry allows quantification of nasal function. This technique recently has been used to demonstrate that adolescents with allergic asthma have increased work of breathing after inhalation of 0.5 ppm sulfur dioxide. Another study using posterior rhinomanometry showed that clerical workers had increased work of breathing after exposure to carbonless copy paper as compared with bond paper. This brief review of upper respiratory tract changes after pollutant exposure should serve as a reminder that a complete clinical history must include questions designed to ascertain the patient's exposure history to both outdoor and indoor air pollutants. These exposures can have a major impact on the health of the upper respiratory system.

Koenig, J.Q., Larson, T.V., Hanley, Q.S., Rebolledo, V., Dumler, K., Checkoway, H., Wang, S.Z., Lin, D., & Pierson, W.E. (1993). **Pulmonary function changes in children associated with fine particulate matter.** *Environ Res* 63(1):26-38.

During winter months many neighborhoods in the Seattle metropolitan area are heavily affected by particulate matter from residential wood burning. A study was conducted to investigate the relationship between fine particulate matter and pulmonary function in young children. The subjects were 326 elementary school children, including 24 asthmatics, who lived in an area with high particulate concentrations predominantly from residential wood burning. FEVI and FVC were measured before, during and after the 1999-1999 and 1999-1990 winter heating seasons. Fine particulate matter was assessed using a light-scattering instrument. Analysis of the relationship between light scattering and lung function indicated that an increase in particulate air pollution was associated with a decline in asthmatic children's pulmonary function. FEV I and FVC in the asthmatic children dropped an average of 34 and 37 ml respectively for each 10(-4) m-I increase in sigma sp. This sigma sp increase corresponds to an increase in PM2.5 of 20 micrograms1m3. It is concluded that fine particulate matter from wood burning is significantly associated with acute respiratory irritation in young asthmatic children.

Koltai, P.J. (1994). **Effects of air pollution on the upper respiratory tract of children.** *Otolaryngol Head Neck Surg* 111(1):9-11.

The impact of the environment on the upper respiratory tract of children has become an issue of recent interest. Sulfur dioxide causes nasal congestion in children as well as an increase in both mast cells and lymphocytes in nasal lavage fluids. Chlorpheniramine blocks the effect of sulfur dioxide on the nasal mucosa. Ozone exposure results in nasal congestion, increased levels of histamine, neutrophils, eosinophils, and mononuclear cells in nasal lavage fluid, No data are available on the effects of nitrogen dioxide or wood-burning stoves on the upper respiratory tracts of children, Formaldehyde in sufficient concentrations causes upper airway irritation; however, no data are available on its long-term effects. Detriments in air quality cause adverse changes in the lower respiratory tracts of susceptible individuals. The effects on the upper respiratory tract are more difficult to document. There may be a causal relationship, but definitive proof of whether air pollution results in significant increases in pediatric otitis media, sinusitis, rhinitis, and pharyngitis has yet to be demonstrated.

Kossove, D. (1982). **Smoke-filled rooms and lower respiratory disease in infants.** *S Afr Med J* 61(17):622-4.

Of 132 infants with severe lower respiratory tract disease, 70% had a history of daily heavy smoke exposure from cooking and/or heating fires. Only 33% of 18 infants free of respiratory problems had such exposure. Wood smoke is a potent risk factor in the developirient of severe lower respiratory tract disease in infants. Lower social class, and sibling and parental symptoms (often cited as risk factors), may also be expressions of the same smoke-filled room. Parents of newborn infants should be told to keep smoke away from their baby, especially if ethnic traditions predicate exposure.

Larson, T.V., & Koenig, J.Q. (1994). Wood smoke: **emissions and noncancer respiratory effects.** *Annu Rev Public Health* 15:133-56.

In conclusion, this review reveals much about the constituents and fate of wood smoke but not enough about the health effects. Animal toxicological studies show that wood smoke exposure can disrupt cellular membranes, depress macrophage activity, destroy ciliated and secretory respiratory epithelial cells, and cause aberrations in biochemical enzyme levels. With respect to the human epidemiological data, the literature summarized in Table 4 shows a coherence of the data from young children, with 7/8 studies especially in children with asthma, reporting increased respiratory symptoms, lower respiratory infection, and decreased pulmonary function as a result of exposure to wood smoke. As Bates (6) has discussed, coherence of the data, although not amenable to statistical tests, carries the weight of linkage and plausibility. These adverse respiratory effects associated with wood smoke exposure also comply with many of Brandon Hill's aspects of association necessary to establish causation (40). There is strength of association, consistency

(7/8 studies showing positive associations), temporality, plausibility, coherence, and analogy (using ETS exposure; 70, 94). A biological gradient has not been shown, although one is suggested in the study of pulmonary function in wildfire fighters. We conclude that the preponderance of the data suggest a causal relationship between elevated wood smoke levels and adverse respiratory health outcomes in young children.

Leigh, M.W., Carson, J.L, & Denny, F.W., Jr. (1991). **Pathogenesis of respiratory infections due to influenza virus: implications for developing countries.** *Rev Infect Dis* 13 (Suppl 6):S501-8.

The influenza viruses have an important and distinctive place among respiratory viruses: they change antigenic character at irregular intervals, infect individuals of all ages, cause illnesses characterized by constitutional symptoms and tracheobronchitis, produce yearly epidemics associated frequently with excess morbidity and mortality, and predispose the host to bacterial superinfections. Much is known about influenza viruses, but their role in respiratory infections among children in developing countries is poorly understood, and the risk factors that lead to the excess morbidity and mortality have not been identified clearly. Among the many risk factors that may be important are alterations in host immunity, malnutrition, prior or coincident infections with other microorganisms, inhaled pollutants, and lack of access to medical care. There is a great need for research that can establish more precisely the role these and other unidentified factors play in the pathogenesis of influenza infections in children in the developing world.

Lercher, P., Schmitzberger, R., & Kofler, W. (1995). **Perceived traffic air pollution, associated behavior and health in an alpine area.** *Sci Total Environ* 169(1-3):71-4.

The relationship of traffic air pollution, perception of exhaust fumes/soot and behavioral impact or symptoms/illnesses was investigated in two surveys (adults: aged 25-65, N = 1989, 62% participation; children: aged 8-12, N = 796, 85% participation) in 13 small alpine communities (Tyrol/Austria) by means of questionnaire responses and air pollution measurements. Although pollutant levels complied with current WHO guidelines, adult respondents felt annoyed by odourous traffic fumes (39.7%) or visible dust/soot (26.9%). Logistic regression analysis revealed that accompanying noise annoyance, rated impairment of life quality, protesting behaviour, noise- and odour-sensitivity was directly associated with perceived air quality, while age above 45 years, smoking, and social support was inversely associated with perceived air quality. Among the symptoms, feelings of fatiguelexhaustion/low mood/nervousness and irritation of the eyes and stomach aches showed a significant association with rated air quality. Children in the traffic exposed areas spend less time outdoors and reported perception of car fumes was significantly associated with recurrent colds, chronic bronchitis and an index of hyperreactive airways. Measured indices of pollution (traffic counts, N02) were not associated with any of the children's reported illnesses.

Lunn, J.E., Knowelden, J., & Handyside, A.J. (1967). **Patterns of respiratory illness in Sheffield infant schoolchildren.** *Br J Prev Soc Med* 21(1):7-16.

Malk S.K (1985). **Exposure to domestic cooking fuels and chronic bronchitis.** *Indian J Chest Dis Allied Sci* 27(3):171-4.

Malik, S.K. (1985). **Cooking fuels and chronic respiratory disease [letter].** *J Assoc Physicians India* 33(5):378.

Marbury, M. (1991). **Wood smoke.** In J. Samet & J. Spengler (Eds.), *IndoorAir Pollution: A Health Perspective* (pp. 209-222). Baltimore and London: The Johns Hopkins University Press.

Marbury, M.C., Maldonado, G., & Waller, L. (1996). **The indoor air and children's health study: methods and incidence rates.** *Epidemiology* 7(2):166-74.

The Indoor Air and Children's Health Study is a prospective cohort study of the relation between indoor air pollution and lower respiratory illness (LRI) during the first 2 years of life. Information on family and household characteristics was obtained from a health maintenance organization for 1,424 infants enrolled at birth. Data on LRI were abstracted from medical records. The incidence of all LRI was 48.4 per 100 child-years. Wheezing-associated respiratory illness (WARI)/asthma was the most common specific LRI, with an incidence of 11.5 per 100 child-years. Total LRI incidence was lowest during the first 6 months of life. Girls had lower incidence than boys [rate ratio (RR) = 0.8; 95% confidence interval (CI) = 0.7-0.8)]. With the exception of croup, all LRI were most common during February and March. These results are comparable with those of other prospective studies. Consistent with other studies, self-reported maternal smoking demonstrated an RR of 1.5 (95% Cl = 1.2-1.8) for total LRI, but the association varied for specific LRIs from 2.3 (95% CI = 1.5-3.0) for WARI/asthma to 1.0 (95% Cl = 0.7-1.6) for bronchitis.

Martin, K. (1991). **Indoor air pollution in developing countries.** *The Lancet* 337:358.

Mavalankar, D.V., Trivedi, C.R., & Grah, R.H. (1991). **Levels and risk factors for perinatal mortality in Ahmedabad, India.** *Bulletin of WHO* 69(4):435-442.

Mazur, B. (1995). **Peak expiratory flow values in children relative to the degree of atmospheric air pollution.** *Acta Paediatr* 84(2):203-5.

The purpose of the study was to determine peak expiratory flow (PEF) values in children from three regions with different degrees of atmospheric pollution. The study included 1415 healthy children aged 7-9 years. In each child five measurrments of PEF (1/min) were performed with a Vitalograph. The highest result was considered. The greatest degree of airway resistance, as reflected in low PEF values, was noted among children living in the Upper Silesian Industrial Region and in the Olkusz region where the degree of atmospheric pollution is high compared with Zarki.

Menezes, A.M., Victora, C.G., & Rigatto, M. (1994). **Prevalence and risk factors for chronic bronchitis in Pelotas, RS, Brazil: a population-based study.** *Thorax* 49(12):1217-21.

BACKGROUND—Chronic bronchitis causes high morbidity and mortality throughout the world. It is basically a preventable disease. However, few population based studies of chronic bronchitis have been carried out in less developed countries. METHODS—A population based cross sectional survey was conducted to determine the prevalence of chronic bronchitis and associated risk factors in an urban area (Pelotas) of southern Brazil. 1053 subjects aged 40 years and over (90.3% of eligible subjects) were interviewed using the ATS-DLD-78 questionnaire. RESULTS—Of the subjects interviewed 12.7% were classified as having chronic bronchitis. In univariate analyses a significant increase in the relative odds of chronic bronchitis was seen in men (OR = 2.17,95% CI 1.50 to 3.13), low family income (OR = 2.60, 95% CI 1.47 to 4.47 for lowest quartile), low schooling (OR = 4.65, 95% CI 2.36 to 9.18 for those with no schooling), smoking habits (OR = 6.92,95% CI 4.22 to 11.36 for smokers of 20 or more cigarettes per day), high occupational exposure to dust SOR = 2.48, 95% CI 1.56 to 3.94), inadequate housing (OR = 2.09, 95% CI 1.22 to 3.58), high level of indoor air pollution (OR = 1.86, 95% CI 1.16 to 2.99), and reported childhood respiratory illnesses (OR = 2.08, 95% Cl 1.25 to 3.49). Multiple logistic regression resulted in the identification of the following independent risk factors: family income (OR = 1.99, 95% CI 1.04 to 3.81 for subjects in the lowest quartile compared with those in the highest quartile), schooling (OR = 5.60, 95% CI 2.52 to 12.45 for subjects with no schooling compared with those with nine or more years), smoking (OR = 8.10, 95% Cl 4.46 to 14.71 for smokers of 20 or more cigarettes per day compared with non-smokers), and history of major respiratory illnesses in childhood (OR = 2.16,95% CI 1.20 to 3.85). CONCLUSIONS—Low family income, poor schooling, smoking, and childhood respiratory illnesses were significantly associated with chronic bronchitis.

Michalickova, J., Karpatova, E., & Fandakova, K. (1993). **[Air pollution and the occurrence of recurrent respiratory tract diseases in children during the first years of life].** *Cesk Pediatr* 48(2):88-93.

The authors investigate in a group of 211 children aged 2-6 years, incl. in particular a group of 33 2-year-old ones, in 1990 and checked in 1991 at two sites in Bratislava—a town with a varying concentration of NOX, S02, dustiness and dust fallout—their influence on the incidence, type and course of relapsing respiratory disease. In both sites the concentrations of the mentioned noxious substances were beneath levels admitted by hygienists. In the place with higher concentrations, in particular of NOX, a significantly higher number of serious forms of relapsing respiratory diseases was recorded and an adverse course of the diseases in 2-6 year-old children and in particular in the 2-year-old ones.

Mishra, S., & Chaturvedi, P. (1995). **Acute respiratory infections with special reference to pneumonia in underfives.** *J Indian Med Assoc* 93(9):351-5.

Mishra, V., & Retherford, R.D. (1997). **Cooking smoke increases the risk of acute respiratory infections in children.** *National Family Health Survey Bulletin #8.* International Institute for Population Sciences, Mumbai, and East-West Center, Honolulu.

Monto, A. (1990). **Acute respiratory infection in children in developing countries: challenge of the 90's.** *Review of Infectious Diseases* 11:498-505.

Morris, K., Morgenlander, M., Coulehan, J.L., Gahagen, S., Arena, V.C., & Morganlander, M. (1990). **Wood-burning stoves and lower respiratory tract infection in American Indian children [published erratum appears in Am J Dis Child 1990 Apr;144(4):490].** *Am J Dis Child* 144(l):105-8.

Some studies suggest that home use of wood-burning stoves is an independent risk factor for lower respiratory tract infection in young children. To test this hypothesis in a population with a high prevalence of wood-burning stove use, we studied Navajo children with diagnosed pneumonia or bronchiolitis. We matched each case (less than or equal to 24 months of age) with a child of identical sex and age who was seen for well-child care or a minor health problem, and we interviewed an adult caretaker about family history and environmental exposures. Analyzing 58 case-control pairs, we found that home wood-burning stove use, recent respiratory illness exposure, family history of asthma, dirt floors, and lack of running water in the home increased the risk of lower respiratory tract infection. On multiple logistic regression analysis, however, only wood-burning stove use and respiratory illness exposure were independently associated with higher risk.

Mtango, F.D., Neuvians, D., Broome, C.V., Hightower, A.W., & Pio, A. (1992). **Risk factors for deaths in children under 5 years old in Bagamoyo district, Tanzania.** *Trop Med Parasitol* 43(4):229-33.

We conducted a population based case control study of deaths in children < 5 years old from Bagamoyo District, Tanzania, to evaluate factors associated with death, and factors associated with not utilizing Government health care system. Six hundred and ten children who died between I July, 1986 and 30 June 1987 were enrolled as cases; 1, 160 healthy control children were selected by multistage random cluster sampling. Twenty-five percent of deaths were ascribed to pneumonia based on "verbal autopsy"; 39% of acute respiratory deaths occur-red in children < 6 months of age. In a multivariate analysis, significant independent associations were found with mother as sole decision maker for treatment (O.R = 0. 13; 95% C:I. 0.07, 0.22); use of water from village well, pond, current gas stove use nor a history of severe chest illness before 2 yr of age were independently associated with lower levels of pulmonary function.

Murray, J.F., & Enarson, D.A. (1992). **World lung health: a concept that should become a reality. The ATS Committee on World Lung Health [editorial] [published erratum appears in Am Rev Respir Dis 1993 Mar;147(3):following 7831.** *Am Rev Respir Dis* 146(4):818-22.

Murtagh, P., Cerqueiro, C., Halac, A., Avila, M., Salomon, H., & Weissenbacher, M. (1993). **Acute lower respiratory infection in Argentinian children: a 40 month clinical and epidemiological study.** *Pediatr Pulmonol* 16(1):1-8.

In a total of 1,003 children (805 inpatients and 198 outpatients) with acute lower respiratory infections (ALRI), clinical, social, and environmental data were analyzed. The major clinical entities were bronchiolitis, pneumonia, bronchitis, and laryngitis. The first two of these predominated in inpatients; pneumonia and bronchitis were more common in older children, while bronchiolitis was observed in infants. Respiratory rates of > 50/min. were more common in younger children and in cases with bronchiolitis and bronchitis. Retractions showed markedly less agedependent variations and were present in all severe cases with different clinical diagnoses. Retractions alone or associated with cyanosis were the best indicators for severity of ALRI. Among outpatients, fever and wheezing were more common; inpatients were younger, more frequently malnourished, and from a lower socioeconomic level; fan-lily history of chronic bronchitis, crowding, and parental smoking also prevailed in this group. Family asthma and exposure to domestic aerosols was more common among outpatients. Prematurity rate (17 and 15%) of all ALRI cases was twice that of the general pediatric population and a significant difference existed between in- and outpatients under 6 months of age when perinatal respiratory pathologies predominated among inpatients. It is suggested to consider the need for assessing personal, family, and environmental risk factors in addition to clinical signs and symptoms when severe cases of ALRI are evaluated.

Narain, J.P. (1987). **Epidemiology of acute respiratory infections.** *Indian J Pediatr* 54(2):153-60.

Neas, L.M., Dockery, D.W., Koutrakis, P., Tollerud, D.J., & Speizer, F.E. (1995). **The association of ambient air pollution with twice daily peak expiratory flow rate measurements in children.** *Am J Epidemiol* 141(2):111-22.

A stratified sample of 83 children living in Uniontown, Pennsylvania, reported twice daily peak expiratory flow rate (PEFR) measurements on 3,582 child-days during the summer of 1990. Upon arising and before retiring, each child recorded the time, three PEFR measurements, and the presence of cold, cough, or wheeze symptoms. Ambient air pollution, including particle-strong acidity, was measured separately during the day (8 a.m. to 8 p.m.) and at night. Each child's maximum PEFR for each session was expressed as the deviation from his or her mean PEFR over the study and adjusted to a standard of 300 liters/minute. The session-specific average deviation was then calculated across all of the children. A second-order autoregressive model for PEFR was developed, which included a separate intercept for evening measurements, trend, temperature, and 12-hour average air pollutant concentration weighted by the number of hours each child spent outdoors during the previous 12-hour period. The results are expressed in terms of the interquartile range for each pollutant. A 12-hour exposure to a 125-nmol/m3 increment in particle-strong acidity was associated with a -2.5 liters/minute deviation in the group mean PEFR (95% confidence interval (CI) -4.2 to -0.8) and with increased cough incidence (odds ratio (OR) = 1.6,95% CI 1.1 to 2.4). A 30-ppb increment in ozone for 12 hours was associated with a similar deviation in PEFR levels (-2.8, 95% CI -67 to 1. 1). The association between PEFR and particle-strong acidity was observed among the 60 children who were reported as symptomatic on the prior symptom questionnaire (-2.5, 95% CI -4.5 to -0.5). 'Me authors conclude that summer occurrences of excessive acid aerosol and particulate pollution are associated with declines in peak expiratory flow rates in children.

Neas, LM., Dockery, D.W., Burge, H., Koub-dids, P., & Speizer, F.E. (1996). **Fungus spores, air pollutants, and other determinants of peak expiratory flow rate in children.** *Am J Epidemiol* 143(8):797-807.

The impact of surnmertime haze episodes on daily variations in symptoms and peak expiratory flow rates (PEFRs) was examined in a study of 108 children living in State College, Pennsylvania, during the summer of 199 1. Twice daily, each child recorded symptoms, PEFRs and hours spent outdoors. Environmental measurements included daily 12- and 24-hour averages for meteorologic and air pollutant variables and 24-hour average fungus spore concentrations. A 10,000-sporelm3 increment in Cladosporiurn spore concentration was associated with a deficit in morning PEFR (- 1.0 liters/minute, 95 % confidence interval (CI) -1.9 to -0.2). A 60-spore/m3 increment in Epicoccurn spore concentration was associated with increased incidence of morning cough (odds ratio (OR) = 1.8, 95% Cl 1.0-3.2) and a deficit in morning PEFR (4.5 liters/minute, 95% CI -2.8 to -0.2). Fungi spore counts were not associated with respirable particle mass. A 125-nmol/m3 increment in 12-hour daytime particle-strong acidity was associated with a deficit in evening PEFR (45 liters/minute, 95% Cl -1.2 to 0.2) and increased incidence of cold episodes that evening or the subsequent morning (OR = 1.35, 95% CI 1.141.61). A 20-microgram/m3 increment in 24-hour respirable particles lagged by 24 hours was associated with a deficit in evening PEFR (45 liters/minute 95% Cl -1.4 to 0.4) and increased incidence of cough episodes that evening or the subsequent morning (OR = 1.37, 95% CI 1. 13-1.66). These results confirm the acute effects of summertime particulate air pollution and suggest that aeroallergens have independent effects on respiratory symptoms and PEFR in children.

Norboo, T., Yahya, M., Bruce, N.G., Heady, J.A., & Ball, K.P. (1991). **Domestic pollution and respiratory illness in a Himalayan village.** *Int J Epidemiol* 20(3):749-57.

Summer and winter surveys of a village in Ladakh have been used to study respiratory illness and domestic pollution from fires in an and high altitude region of northern India. The prevalence of chronic cough with chronic phlegm rose steeply with age, and was greater among women than men. The percentage of villagers with a forced expiratory volume in one second/forced vital capacity (FEVI/FVC) ratio of less than 65% also rose with age, to include 24% of men and 32% of women over 50 years in the summer survey. Lung function was significantly worse in those reporting chronic cough, independently of age and sex (p less than 0.001). Carbon monoxide (CO) measurements were used to assess domestic pollution from fires. Amongst the small minority of smokers (all men) CO in exhaled air was higher than in non-smoking men. In non-smoking men and the women, levels of exhaled CO were very significantly higher in winter than in summer, as were the levels of CO measured in the houses. There was a fall in FEV I (but not FVQ between summer and winter (p less than 0.0001), and an association was found between individual change from summer to winter in exhaled air CO and the individual change in FEV1 (p less than 0.01). A significant negative association was found between the winter value of CO in exhaled air and FEVI/FVC ratio in women (p less than 0.05), although a similar association in men was nonsignificant. No significant associations were found between winter pollution levels and the presence of chronic symptoms.(ABSTRACT TRUNCATED AT 250 WORDS)

O. Dempsey, T., McArdle, T.F., Morris, J., Lloyd-Evans, N., Baldeh, I., Laurence, B.E., Secka, O., & Greenwood, B.M. (1996). **A study of risk factors for pneumococcal disease among children in a rural area of west Africa.** *Int J Epidemiol* 25(4):885-93.

BACKGROUND: Pneumoccal infection is one of the leading causes of pneumonia, meningitis and septicaernia in developing countries. We have investigated possible risk factors for pneumococcal disease among children living in a rural area of The Gambia. METHODS: A prospective case-control study was conducted in which children with pneumococcal infection were identified from among children attending out-patient and under-fives clinics and matched according to age with healthy children selected randon-dy from the local community. A questionnaire was used to investigate possible nutritional, medical, socioeconomic

and environmental risk factors for pneumococcal disease. RESULTS: An increased risk of pneumococcal disease was associated with poor weight gain, a history of serious illness in the previous 6 months, exposure to cigarette smoke or being carried on mother's back while cooking. The risk of pneumococcal disease was reduced among children whose mothers had a personal source of income. CONCLUSIONS: The incidence of pneumococcal disease could be reduced by improving nutrition and taking steps to identify and rehabilitate those children whose weight is faltering or falling. Encouraging mothers to develop greater financial independence may also be beneficial. Reduced exposure to smoke should be promoted by improving ventilation in kitchens, introducing more efficient and less polluting stoves, keeping children away from smoky environments and discouraging parental smoking.

Ogston, S.A., Florey, C.D., & Walker, C.H. (1987). **Association of infant alimentary and respiratory illness with parental smoking and other environmental factors.** *J Epidemiol Community Health* 41(1):21-5.

The incidences of alimentary and respiratory illnesses were observed during the first year of life in 1565 infants born in Tayside during 1980. Significant correlations (p less than 0.05) were found between each of these outcomes and parental smoking, maternal age, social class, method of infant feeding, and heating fuels. Multiple logistic regression indicated a significant independent effect of parental smoking was related separately to alimentary and to respiratory outcomes, the relative risks being of similar strength.

Osborne, J., & Honicky, R. (1990). **Health effects of heating with woodburning stoves: a prospective study of chronic symptoms of respiratory disease in young children.** Paper presented at the Proceedings of the 5th International Conference on Indoor Air Quality and Climate, July 29- August 3, Toronto, Canada.

Ostro, B.D. (1989). **Estimating the risks of smoking, air pollution, and passive smoke on acute respiratory conditions.** *Risk Anal* 9(2):189-96.

Five years of the annual Health Interview Survey, conducted by the National Center for Health Statistics, are used to estimate the effects of air pollution, smoking, and environmental tobacco smoke on respiratory restrictions in activity for adults, and bed disability for children. After adjusting for several socioeconomic factors, the multiple regression estimates indicate that an independent and statistically significant association exists between these three forms of air pollution and respiratory morbidity. The comparative risks of these exposures are computed and the plausibility of the relative risks is examined by comparing the equivalent doses with actual measurements of exposure taken in the homes of smokers. The results indicate that: (1) smokers will have a 55-75% excess in days with respiratory conditions severe enough to cause reductions in normal activity; (2) a I microgram increase in fine particulate matter air pollution is associated with a 3% excess in acute respiratory disease; and (3) a pack-a-day smoker will increase respiratory restricted days for a nonsmoking spouse by 20% and increase the number of bed disability days for young children living in the household by 20%. The results also indicate that the estimates of the effects of secondhand smoking on children are improved when the mother's work status is known and incorporated into the exposure estimate.

Ostro, B.D., & Rothschild, S. (1989). **Air pollution and acute respiratory morbidity: an observational study of multiple pollutants.** *Environ Res* 50(2):238-47.

Recently there have been several attempts to estimate the health and economic effects of one or more airborne pollutants using the Health Interview Survey (HIS), a large cross-sectional database collected by the National Center for Health Statistics. The ultimate implications of these studies are unclear, however, since they frequently include different pollutants and health outcomes in the regression analysis. This paper attempts to determine the separate health consequences of two air pollutants common to the urban environment, ozone and particulate matter, using six separate years of the HIS. The results, using a fixed

effects model that controls for intercity differences, indicate an association between smaller size particles (fine particulate) and both minor restrictions in activity and respiratory conditions severe enough to result in work loss and bed disability in adults. Ozone, on the other hand, appears to be associated only with the more minor restrictions. However, the measurement error associated with estimating exposure to ozone may limit the usefulness of the HIS which relies on a 2-week recall of health status. The results are compared with other studies using the HIS and related studies involving acute respiratory symptoms.

Ostro, B. (1993). **The association of air pollution and mortality: examining the case for inference.** *Arch Environ Health* 48(5):336-42.

An association between air pollution measured as particulate matter, and mortality has been reported in several different locations. These studies have been conducted over a wide range of climates and populations. The time-series studies, which examine the joint occurrence of daily fluctuations in air pollution and mortality, provide the strongest evidence of a true association. However, several criteria, including the consistency of the results, need to be explored before causality is inferred from these studies. A striking consistency in the results was observed, after the different studies were converted into a common metric. The mean effect of an 10 micrograms/m3 change in PM10 implied by these studies varies between 0.64 and 1.49%. The fulfillment of other criteria, including specificity, presence of a dose-response relationship, and coherence of results, lend strong support to the existence of an actual association between particulate matter and mortality. However, the biologic mechanism is not well understood at this time. In addition, the precise measure of the pollutant responsible for the health effect—total suspended particles, PM10, fine particles, sulfates, acidic aerosols, sulfur dioxide, or some as yet unmeasured pollutant—is unclear, based on current available evidence.

Pandey, M. (1984). **Domestic smoke pollution and chronic bronchitis in a rural community of the hill region of Nepal.** *Thorax* 39:337-339.

Pandey, M.R., Regmi, H.N., Neupane, R.P., Gautam, A., & Bliandari, D.P. (1985). **Domestic smoke pollution and respiratory function in rural Nepal.** *Tokai J Exp Clin Med* 10(4):471-81.

A study was conducted to see the effect of domestic smoke pollution on respiratory function by using vitalograph Model 20.400 S-type dry portable spirometer in 150 randomly selected female subjects aged 30-44 years from a rural area situated in the outskirts of Kathmandu valley at an altitude of 4,800 ft. above sea level. The area is totally free from industrial and atmospheric pollution. Women spend considerable time near the fireplace, which serves both cooking and heating* purposes and emits smoke from wood and other biomass fuel. Domestic smoke pollution is considerable because dwellings are ill-ventilated and without chimnies. The selected sample comprised of 6 groups-25 subjects each of 3 exposure levels to domestic smoke pollution amongst smokers and non-smokers. All the spirometric tests (FV0, FEV I and FMEF 25-75) were performed in a standard way as recommended by American Thoracic Society in Snowbird Meeting in 1979. Variation of age, height, arm-span and weight between the three different levels of exposure to domestic smoke in both the smokers and non-smokers were compared and results revealed no significant variation in all the variables mentioned above. There was a fall of mean FVC, FEVI and FN1EF 25-75 as duration of exposure increased. This decline was found to be statistically significant amongst the smokers but not amongst the non-smokers. Similar results was found even after adjusting for age & height.

Pandey, M., Neapane, R., & Gautam, A. (1987). **Domestic smoke pollution and acute respiratory infection in Nepal.** Paper presented at the Indoor Air ‘87: Proceedings of the 4th International Conference on Indoor Air Quality and Climate, 17-21 August, Berlin (West).

Pandey, M., Basnyat, B., & Neupane, R. (1988). **Chronic Bronchitis and Cor Pulmonale in Nepal.** (First ed.). Kathmandu, Nepal: Mrigendra Medical Trust.

Pandey, M.R., Boleij, J.S., Smith, K.R., & Wafula, E.M. (1989). **Indoor air pollution in developing countries and acute respiratory infection in children.** *Lancet* 1(8635):427-9.

Pandey, M., Neupane, R., Gautam, A., & Shresdia, I. (1989). **Domestic smoke pollution and acute respiratory infections in a rural community of the hill region of Nepal.** *Environment International* 15:337-340.

Pandey, M. (1997). **Women, wood energy and health.** *Wood Energy News* 12(1):3-5.

Penna, M.L., & Duchiade, M.P. (1991). **[Air pollution and infant mortality from pneumonia].** *Bol Oficina Sanit Panam* 110(3):199-207. [Portuguese]

This study examines the relationship between air pollution, measured as concentration of suspended particulates in the atmosphere, and infant mortality due to pneumonia in the metropolitan area of Rio de Janeiro. Multiple linear regression (progressive or stepwise method) was used to analyze infant mortality due to pneumonia, diarrhea, and all causes in 1980, by geographic area, income level, and degree of contamination. While the variable “proportion of families with income equivalent to more than two minimum wages” was included in the regressions corresponding to the three types of infant mortality, the average contamination index had a statistically significant coefficient (b = 0.2208; t = 2.670; P = 0.0137) only in the case of mortality due to pneumonia. This would suggest a biological association, but, as in any ecological study, such conclusions should be viewed with caution. We believe that air quality indicators are essential to consider in studies of acute respiratory infections in developing countries.

Penna, M.L., & Duchiade, M.P. (1991). **Air pollution and infant mortality from pneumonia in the Rio de Janeiro metropolitan area.** *Bull Pan Am Health Organ* 25(1):47-54.

The authors report the results of an investigation into the possible association between air pollution and infant mortality from pneumonia in the Rio de Janeiro Metropolitan Area. This investigation employed multiple linear regression analysis (stepwise method) for infant mortality from pneumonia in 1980, including the study population's areas of residence, incomes, and pollution exposure as independent variables. With the income variable included in the regression, a statistically significant association was observed between the average annual level of particulates and infant mortality from pneumonia. While this finding should be accepted with caution, it does suggest a biological association between these variables. The authors’ conclusion is that air quality indicators should be included in studies of acute respiratory infections in developing countries.

Perez-Padiffa, R., Regalado, J., Vedal, S., Pare, P., Chapela, R., Sansores, R., & Selman, M. (1996). **Exposure to biomass smoke and chronic airway disease in Mexican women. A case-control study.** *Am J Respir Crit Care Med* 154(3 Pt 1):701-6.

A case-control study was performed in women older than 40 yr of age to evaluate the risk of cooking with traditional wood stoves for chronic bronchitis and chronic airway obstruction (CAO). The subjects were recruited from patients attending a referral chest hospital in Mexico City. We selected 127 patients with chronic bronchitis or CAO, of which 63 had chronic bronchitis alone, 23 had CAO alone (FEVI less than 75% of predicted), and 41 had both chronic bronchitis and CAO (cases). Four control groups were selected: 83 patients with pulmonary tuberculosis, 100 patients with interstitial lung diseases, 97 patients with ear, nose and throat ailments, and 95 healthy visitors to the hospital (controls). Exposure to wood smoke, assessed as any or none, and as hour-years (years of exposure multiplied by average hours of exposure per

day) was significantly higher in cases than in controls. Crude odds ratios for wood smoke exposure were 3.9 (95% CI, 2.0 to 7.6) for chronic bronchitis only, 9.7 (95% CI, 3.7 to 27) for CAO plus chronic bronchitis, and 1.8 (95% CI, 0.7 to 4.7) for CAO only. Differences in exposure to wood smoke persisted after adjusting by stratification and logistic regression for age, income, education, smoking, place of residence, and place of birth. Risk of chronic bronchitis alone and chronic bronchitis with CAD increased linearly with hour-years of cooking with a wood stove; odds ratios for exposure to more than 200 hour-years compared with nonexposed were 15.0 (95% CI, 5.6 to 40) for chronic bronchitis only and 75 (95% CI, 18 to 306) for chronic bronchitis with CAO. The findings support a causal role of domestic wood smoke exposure in chronic bronchitis and chronic airflow obstruction.

Pershagen, G., Rylander, E., Norberg, S., Eriksson, M., & Nordvall, S.L. (1995). **Air pollution involving nitrogen dioxide exposure and wheezing bronchitis in children.** *Int J Epidemiol* 24(6):1147-53.

BACKGROUND: A population-based case-control study was performed in Stockholm to assess the influence of air pollution on the occurrence of severe wheezing bronchitis in children. METHODS: The study included 197 children aged 4 months to 4 years, who were hospitalized because of breathing difficulties with wheezing, and 350 population controls. Information on potential risk factors for childhood wheezing and a residential history was obtained at home interview with parents. Outdoor nitrogen dioxide (N02) concentrations at home addresses and day care centres from birth on were estimated from validated models, mainly using data on traffic intensity from municipal registers. RESULTS: The risk of wheezing bronchitis was related to time-weighted mean outdoor N02 exposure in girls (P = 0.02), but not in boys. A gas stove in the home appeared to be a risk factor primarily for girls. All analyses controlled for parental asthma and maternal smoking, which were independent risk factors for wheezing bronchitis. CONCLUSIONS: The results suggest that exposure to combustion products containing N02 may be of particular importance for the development of wheezing bronchitis in girls.

Pierson, W.E., Koenig, J.Q., & Bardana, E.J., Jr. (1989). **Potential adverse health effects of wood smoke.** *West J Med* 151(3):339-42.

The use of wood stoves has increased greatly in the past decade, causing concern in many communities about the health effects of wood smoke. Wood smoke is known to contain such compounds as carbon monoxide, nitrogen oxides, sulfur oxides, aldehydes, polycyclic aromatic hydrocarbons, and fine respirable particulate matter. All of these have been shown to cause deleterious physiologic responses in laboratory studies in humans. Some compounds found in wood smoke-benzo[a]pyrene and formaldehyde—are possible human carcinogens. Fine particulate matter has been associated with decreased pulmonary function in children and with increased chronic lung disease in Nepal, where exposure to very high amounts of wood smoke occurs in residences. Wood smoke ftimes, taken from both outdoor and indoor samples, have shown mutagenic activity in short-term bioassay tests. Because of the potential health effects of wood smoke, exposure to this source of air pollution should be minimal.

Ponka, A. (1990). **Absenteeism and respiratory disease among children and adults in Helsinki in relation to low-level air pollution and temperature.** *Environ Res* 52(l):34-46.

The weekly changes in ambient sulfur dioxide, nitrogen dioxide, and temperature were compared with the figures for respiratory infection in children and adults and for absenteeism from day-care centers (DCQ, schools, and workplaces during a 1 -year period in Helsinki. The annual average level of sulfur dioxide was 21 micrograms/m3 and of nitrogen dioxide 47 rnicrograms/m3; the average temperature was +3.1 degrees C. The levels of these pollutants and the temperature were sigrifficantly correlated with the number of upper respiratory infections reported from health centers. Low temperature also correlated with increased frequency of acute tonsillitis, of lower respiratory tract infection among DCC children, and of absenteeism from day-care centers, schools and workplaces. Furthermore, a significant association was found between

levels of sulfur dioxide and absenteeistri. After statistical standardization for temperature, no other correlations were observed apart from that between high levels of sulfur dioxide and numbers of upper respiratory tract infections diagnosed at health centers (P = 0.04). When the concentrations of sulfur dioxide were above the mean, the frequency of the upper respiratory tract infections was 15% higher than that during the periods of low concentration. The relative importance of the effects of lowlevel air pollution and low temperature on health is difficult to assess.

Pope, C.A.d. (1989). **Respiratory disease associated with community air pollution and a steel mill, Utah Valley.** *Am J Public Health* 79(5):623-8.

This study assessed the association between hospital admissions and fine particulate pollution (PM10) in Utah Valley during the period April 1985-February 1988. This time period included the closure and reopening of the local steel mill, the primary source of PMIO. An association between elevated PMIO levels and hospital adirtissions for pneumonia, pleurisy, bronchitis, and asthma was observed. During months when 24-hour PM10 levels exceeded 150 micrograms/m3, average admissions for children nearly tripled; in adults, the increase in admissions was 44 per cent. During months with mean PM10 levels greater than or equal to 50 micrograms/m3 average admissions for children and adults increased by 89 and 47 per cent~ respectively. During the winter months when the steel mill was open, PM 10 levels were nearly double the levels experienced during the winter months when the mill was closed. This occurred even though relatively stagnant air was experienced during the winter the mill was closed. Children's admissions were two to three times higher during the winters when the mill was open compared to when it was closed. Regression analysis also revealed that PMIO levels were strongly correlated with hospital admissions. They were more strongly correlated with children's admissions than with adult admissions and were more strongly correlated with admissions for bronchitis and asthma than with admissions for pneumonia and pleurisy.

Pope, C.A.d., Dockery, D.W., Spengler, J.D., & Raizenne, M.E. (1991). **Respiratory health and PM10 pollution.** A **daily time series analysis.** *Am Rev Respir Dis* 144(3 Pt 1):668-74.

This study evaluated changes in respiratory health associated with daily changes in fine particulate pollution (PM 10). Participants included a relatively healthy school-based sample of fourth and fifth grade elementary students, and a sample of patients with asthma 8 to 72 yr of age. Elevated PM10 pollution levels of 150 micrograms/m3 were associated with an approximately 3 to 6% decline in lung function as measured by peak expiratory flow (PEF). Current day and daily lagged associations between PMIO levels and PEF were observed. Elevated levels of PM10 pollution also were associated with increases in reported symptoms of respiratory disease and use of asthma medication. Associations between compromised respiratory health and elevated PM 10 pollution were observed even when PM 10 levels were well below the 24-h national ambient air quality standard of 150 micrograms/m3. Associations between elevated PM 10 levels, reductions in PEF, and increases in symptoms of respiratory disease and asthma medication use remained statistically significant even when the only pollution episode that exceeded te standard was excluded. Concurrent measurements indicated that little or no strong particle acidity was present.

Pope, C.A.d., & Dockery, D.W. (1992). **Acute health effects of PM10 pollution on symptomatic and asymptornatic children.** *Am Rev Respir Dis* 145(5):1123-8.

This study assessed the association between daily changes in respiratory health and respirable particulate pollution (PMIO) in Utah Valley during the winter of 1990-1991. During the study period, 24-h PMIO concentrations ranged from 7 to 251 micrograms/m3. Participants included symptomatic and asymptornatic samples of fifth- and sixth-grade students. Relatively small but statistically significant (p less than 0.01) negative associations between peak expiratory flow (PEF) and PMIO were observed for both the symptomatic and asymptomatic samples. The association was strongest for the symptomatic children. Large associations between the incidence of respiratory symptoms, especially cough, and PMIO pollution were also

observed for both samples. Again the association was strongest for the symptomatic sample. Immediate and delayed PMIO effects were observed. Respiratory symptoms and PEF changes were more closely associated with 5-day moving-average PM10 levels than with concurrent-day levels. These associations were also observed at PM10 levels below the 24-h standard of 150 micrograms/mI This study indicates that both symptomatic and asymptomatic children may suffer acute health effects of respirable particulate pollution, with symptomatic children suffering the most.

Pope, C.A., 3rd, Bates, D.V., & Raizenne, M.E. (1995). Health effects of **particulate air pollution: time for reassessment?** *Environ Health Perspect* 103(5):472-80.

Numerous studies have observed health effects of particulate air pollution. Compared to early studies that focused on severe air pollution episodes, recent studies are more relevant to understanding health effects of pollution at levels common to contemporary cities in the developed world. We review recent epiderniologic studies that evaluated health effects of particulate air pollution and conclude that respirable particulate air pollution is likely an important contributing factor to respiratory disease. Observed health effects include increased respiratory symptoms, decreased lung function, increased hospitalizations and other health care visits for respiratory and cardiovascular disease, increased respiratory morbidity as measured by absenteeism from work or school or other restrictions in activity, and increased cardiopulmonary disease mortality. These health effects are observed at levels common to many U.S. cities including levels below current U.S. National Ambient Air Quality Standards for particulate air pollution.

Pope, C.A., 3rd. (1996). **Adverse health effects of air pollutants in a nonsmoking population.** *Toxicology* 111(1-3):149-55.

Utah Valley has provided an interesting and unique opportunity to evaluate the health effects of respirable particulate air pollution (PM10). Residents of this valley are predominantly nonsmoking members of the Church of Jesus Christ of Latter-day Saints (Mormons). The area has moderately high average PM10 levels with periods of highly elevated PM10 concentrations due to local emissions being trapped in a stagnant air mass near the valley floor during low-level temperature inversion episodes. Due to a labor dispute, there was intermittent operation of the single largest pollution source, an old integrated steel mill. Levels of other common pollutants including sulfur dioxide, ozone, and acidic aerosol are relatively low. Studies specific to Utah Valley have observed that elevated PMIO concentrations are associated with: (1) decreased lung function; (2) increased incidence of respiratory symptoms; (3) increased school absenteeism; (4) increased respiratory hospital admissions; and (5) increased mortality, especially respiratory and cardiovascular mortality.

Pope, C.A., 3rd. (1996). **Particulate pollution and health: a review of the Utah valley experience.** *J Expo Anal Environ Epidemiol* 6(l):23-34.

Utah Valley has provided an interesting and unique opportunity to evaluate the health effects of respirable particulate pollution (PM 10) for several reasons. (1) It has moderately high average PM 10 levels, and during low-level temperature inversion episodes, local emissions may become trapped in a stagnant air mass near the valley floor, resulting in highly elevated PMIO concentrations. (2) The valley experienced the intermittent operation of the local integrated steel mill, the largest single particulate pollution source. (3) Valley residents have very low smoking rates. (4) Levels of sulfur dioxide, ozone, and aerosol strong acidity are relatively low. Several studies specific to Utah Valley have evaluated associations between various indicators of health and PMIO pollution. Each of these individual studies has limitations imposed by data and analytic constraints. Taken together, however, they suggest a coherence or cascade of associations across various health end points for a specific location and population. Apparent health effects of elevated PM 10 pollution observed in Utah Valley include: 1) decreased lung function; 2) increased incidence of respiratory symptoms; 3) increased school absenteeism; 4) increased respiratory hospital admissions; 5) increased mortality,

especially respiratory and cardiovascular mortality, and 6) possibly increased lung cancer. This paper reviews these Utah Valley studies and evaluates the possibility that the overall health associations observed are due primarily to methodological bias or confounding by inadequate controls for risk factors such as smoking, weather, season, infectious agents, and socioeconomic distress.

Raizenne, M., Neas, L.M., Damokosh, A.I., Dockery, D.W., Spengler, J.D., Koutrakis, P., Ware, J.H., & Speizer, F.E. (1996). **Health effects of acid aerosols on North American children: pulmonary function.** *Environ Health Perspect* 104(5):506-14.

We examined the health effects of exposure to acidic air pollution among children living in 24 communities in the United States and Canada. Parents of children between the ages of 8 and 12 completed a self-administered questionnaire and provided consent for their child to perform a standardized forced expiratory maneuver at school in 22 of these communities. Air quality and meteorology were measured in each community for the year preceding the pulmonary function tests. Forced vital capacity (FVC) and forced expiratory volume in I sec (FEV1.0) measurements of 10,251 white children were examined in a two-stage regression analysis that adjusted for age, sex, height, weight, and sex-height interaction. In this study, a 52 nmol/m3 difference in annual mean partile strong acidity was associated with a 3.5% (95% CI, 2.0-4.9) decrement in adjusted FVC and a 3.1% (95% CI, 1.6-4.6) decrement in adjusted FEV1.0. The FVC decrement was larger, although not significantly different, for children who were lifelong residents of their communities (4.1%, 95% CI, 2.5-5.8). The relative odds for low lung function (that is, measured FVC less than or equal to 85% of predicted), was 2.5 (95% CI, 1. 8-3.6) across the range of particle strong acidity exposures. These data suggest that long-term exposure to ambient particle strong acidity may have a deleterious effect on lung growth, development, and function.

Ramakrishna, J., & Joshi, V. (1995). **A framework for addressing health concerns related to cookstoves.** *Energy for Sustainable Development* 1(6):33-37.

Ransom, M.R., & Pope, C.A.d. (1992). **Elementary school absences and PMIO pollution in Utah Valley.** *Environ Res* 58(2):204-19.

This study assessed the association between school absenteeism and respirable particulate pollution (PMIO) in Utah Valley for the six school years of 1985 to 1990. Weekly absenteeism data from the Provo School District and daily data from a single elementary school in the Alpine School District were analyzed for kindergarten through sixth grade. PM10 concentrations during the study period averaged approximately 50 micrograms/m3 with the 24-hr maximum equal to 365 microgramslm3. Absenteeism was regressed on PM 10 pollution levels, temperature, snowfall, and variables indicating day of week, month of school year, and days preceding and following holidays and extended weekends. Estimated associations between absenteeism and PM10 pollution in both data sets were positive, statistically significant (P less than 0.01), and robust to different model specifications. PM 10 effects persisted for up to 3 or 4 weeks. Regression results from both data sets indicated that an increase in 28-day moving average PM10 equal to 100 micrograms/m3 was associated with an increase in the absence rate equal to approximately two percentage points, or an increase in overall absences equal to approximately 40%. Similar relationships were observed for all grade levels, although the response of absences to air pollution was generally greater for grades 1-3 compared with grades 4-6. Associations between absenteeism and PM10 pollution were observed even for levels below 150 n-ticrograms/m3.

Robin, L.F., Less, P.S., Winget, M., Steinhoff, M., Moulton, L.H., Santosham, M., & Correa, A. (1996). **Wood-burning stoves and lower respiratory illnesses in Navajo children.** *Pediatr Infect Dis J* 15(10):859-65.

BACKGROUND: Acute lower respiratory illnesses (ALRI) have been associated with exposure to domestic smoke. To examine further this association, a case-control study was conducted among Navajo children seen at the Public Health Service Indian Hospital at Fort Defiance, AZ. METHODS: Cases, children hospitalized with an ALRI (n = 45), were ascertained from the inpatient logs during October, 1992, through March, 1993. Controls, children who had a health record at the same hospital and had never been hospitalized for ALRI, were matched 1: 1 to cases on date of birth and gender. Home interviews of parents of subjects during March and April, 1993, elicited information on heating and cooking fuels and other household characteristics. Indoor air samples were collected for determination of time-weighted average concentrations of respirable particles (i.e. < 10 microns in diameter). RESULTS: Age of cases at the time of admission ranged from I to 24 months (median, 7 months); 60% of the cases were male. Matched pair analysis revealed an increased risk of ALRI for children living in households that cooked with any wood (odds ratio (OR), 5.0; 95% confidence interval (CI), 0.6 to 42.8), had indoor air concentrations of respirable particles > or = 65 micrograms/m3 (i.e. 90th percentile) (OR 7.0, 95% CI 0.9 to 56.9), and where the primary caretaker was other than the mother (OR 9, 95% Cl 1.1 to 71.4). Individual adjustment for potential confounders resulted in minor change (i.e. < 20%) in these results. Indoor air concentration of respirable particles was positively correlated with cooking and heating with wood (P < 0.02) but not with other sources of combustion emissions. CONCLUSIONS: Cooking with wood-buming stoves was associated with higher indoor air concentrations of respirable particles and with an increased risk of ALRI in Navajo children.

Roemer, W., Hoek, G., & Brunekreef, B. (1993). Effect of **ambient winter air pollution on respiratory health of children with chronic respiratory symptoms.** *Am Rev Respir Dis* 147(l):118-24.

The acute respiratory effects of ambient air pollution were studied in a panel of 73 children with chronic respiratory symptoms in the winter of 1990 to 1991. The participating children were selected from all children aged 6 to 12 yr in Wageningen and Bennekom, two small, nonindustrial towns in the east of the Netherlands. Peak flow was measured twice daily with MiniWright meters. A diary was used to register the occurrence of acute respiratory symptoms and medication use by the children. Exposure to air pollution was characterized by the ambient concentrations of sulfur dioxide (S02), nitrogen dioxide (N02), black smoke (BS), and particulate matter less than 10 microns (PM 10). Associations between air pollution concentrations and health outcomes were analyzed using time series analysis. During the study period an air pollution episode occurred, with moderately elevated concentrations of PM10 and S02. There were 6 days with 24-h average PMl0 concentrations in excess of the WHO suggested lowest observed effect level of 110 micrograms/m3. After adjustment for ambient temperature, there were small but statistically significant negative associations of PMI 0, BS, and S02 with both morning and evening PEF. There was a consistent positive association between PMIO, BS, and S02 with the prevalence of wheeze and bronchodilator use. Overall, the observed associations suggest a mild to moderate response to these moderately elevated levels of air pollution in a group of potentially sensitive children.

Saldiva, P.H., Lichtenfels, A.J., Paiva, P.S., Barone, I.A., Martins, M.A., Massad, E., Pereira, J.C., Xavier, V.P., Singer, I.M., & Bohm, G.M. (1994). **Association between air pollution and mortality due to respiratory diseases in children in Sao Paulo, Brazil: a preliminary report.** *Environ Res* 65(2):218-25.

This work presents the results of a time series study relating air pollution and respiratory mortality in children under 5)ears of age in the metropolitan area of Sao Paulo, Brazil. Daily records of mortality (excluding neonatal mortality) for the period May 1990 to April 1991 were collected along with daily records of relative humidity, temperature, S02, CO, particulates (PMIO), 03, and NOx concentrations. Using multiple regression methods we demonstrated a significant association between mortality due to respiratory diseases and the NOx levels. After controlling for weather and season effects, the odds of dying due to respiratory diseases, considering the mean levels of NOx in Sao Paulo, was estimated at 1.3 (+/- 0. 13). 'Ibis result is in

accord with previous animal studies conducted by our group and indicates that air pollution in Sao Paulo has reached levels high enough to have adverse health effects on the exposed population.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1987). **Health effects and sources of indoor air pollution.** Part 1. *Am Rev Respir Dis* 136(6):1486-508.

Since the early 1970s, the health effects of indoor air pollution have been investigated with increasing intensity. Consequently, a large body of literature is now available on diverse aspects of indoor air pollution: sources, concentrations, health effects, engineering, and policy. This review begins with a review of the principal pollutants found in indoor environments and their sources. Subsequently, exposure to indoor air pollutants and health effects are considered, with an emphasis on those indoor air quality problems of greatest concern at present: passive exposure to tobacco smoke, nitrogen dioxide from gas-fueled cooking stoves, formaldehyde exposure, radon daughter exposure, and the diverse health problems encountered by workers in newer sealed office buildings. The review concludes by briefly addressing assessment of indoor air quality, control technology, research needs, and clinical implications.

Samet, I.M., Marbury, M.C., & Spengler, J.D. (1988). **Health effects and sources of indoor air pollution.** Part H. *Am Rev Respir Dis* 137(1):221-42.

Samet, J.M., Marbury, M.C., & Spengler, J.D. (1987). **Respiratory effects of indoor air pollution.** *J Allergy Clin Immunol* 79(5):685-700.

Since the early 1970s, the health effects of indoor air pollution have been investigated with increasing intensity. A large body of literature is now available on diverse aspects of indoor air pollution: sources, concentrations, health effects, engineering, and policy. This article provides a selective summary of this new information with an emphasis on health effects relevant to health care practitioners concerned primarily with immunologically mediated respiratory diseases. We address exposures associated with acute and chronic respiratory effects: tobacco smoke, nitrogen dioxide, wood smoke, and formaldehyde. The article also describes the diverse health problems experienced by workers in newer sealed office buildings. The importance of indoor concentrations in determining personal exposures to pollutants is emphasized.

Samet, I.M., & Spengler, I.D. (1989). **Nitrogen dioidde and respiratory infection: pilot investigations.** *Res Rep Health Eff Inst* (28):1-32.

Laboratory and human studies have raised concern that exposure to nitrogen dioxide may increase the frequency and severity of respiratory infections in children and adults. Cooking with a natural-gas-fueled stove exposes a home's residents to short-term peaks of nitrogen oxides and to higher average levels of nitrogen oxides than are measured in homes with electric stoves. We have designed a longitudinal study of infants to determine if nitrogen dioxide exposure from cooking stoves increases the incidence or severity of respiratory infections during the first 18 months of life. Pilot investigations for the longitudinal study were conducted from 1984 through 1986. This report provides the results of the pilot investigations. The first study, conducted in 1984 and 1985, was designed to document (1) that appropriate subjects could be recruited; (2) that nitrogen dioxide concentrations in Albuquerque homes were in the range of interest; (3) that an infant's personal exposure to nitrogen dioxide could be estimated; and (4) that a valid, feasible approach for surveillance could be implemented. To accomplish these goals, the families of infants were recruited at two Albuquerque hospitals, and their homes were monitored for nitrogen dioxide using a passive sampling tube. With this approach, we successfully recruited 147 households; monitoring for nitrogen dioxide showed substantially higher levels in homes with gas stoves than in homes with electric stoves, as previously fr~und in other U.S. cities. More detailed investigations in a sample of the homes showed that personal exposures of the infants, who did not attend day care, could be satisfactorily estimated by room concentrations. We also demonstrated that mothers would complete a daily calendar-diary on respiratory

symptoms and provide information every two weeks on illnesses occurring since the previous surveillance call. The second pilot study, conducted in 1986, was designed to refine the system for illness surveillance. Additional goals were to test further the methods for exposure assessment and to evaluate recruitment of subjects through pediatric practices. We recruited 75 infants and followed them over a four-month period. Information from the surveillance system was compared with the clinical assessments of the project's nurse practitioner and the subjects' physicians, and with the results of viral cultures. We also evaluated biweekly versus weekly surveillance calls. Overall, the results of the second pilot study documented that a surveillance system for respiratory illness that incorporates calendar-diaries and biweekly telephone calls is a feasible, relatively unbiased, and sensitive method for studying respiratory illness in a large population of infants. We also found that subjects could be successfully recruited through a pediatric practice.(ABSTRACT TRUNCATED AT 400 WORDS)

Samet, J.M., & Speizer, F.E. (1993). **Assessment of health effects in epidemiologic studies of air pollution.** *Environ Health Perspect* 101 (Suppl 4):149-54.

As we increasingly recognize the complexity of the pollutants in indoor and outdoor microenvironments, a broad array of inhaled mixtures has assumed scientific, public health, and regulatory importance. Few adverse effects of environmental pollutants are specific, that is, uniquely associated with a single agent; the adverse effects that might be considered in an investigation of the consequences of exposure to an inhaled complex mixture are generally nonspecific. In the context of this paper, we will refer to binary mixtures as complex, though we realize that a more precise definition of complexity would restrict the term to mixtures of three or more constituents. Their causes potentially include not only pollutant exposures through the medium of inhaled air but other environmental agents, such as infectious organisms and radiation, and inherent characteristics of the exposed persons, such as atopy. We review the outcome measures that have been used in epidemiologic studies of the health effects of single pollutants and complex mixtures. Some of these outcome measures have been carefully standardized, whereas others need similar standardization and modification to improve sensitivity and specificity for investigating the health effects of air pollution.

Samet, J.M., Lambert, W.E., Skipper, B.J., Cushing, A.H., Hunt, W.C., Young, S.A., McLaren, L.C., Schwab, M., & Spengler, J.D. (1993). **Nitrogen dioxide and respiratory illnesses in infants.** *Am Rev Respir Dis* 148(5):1258-65.

Nitrogen dioxide is an oxidant gas that contaminates outdoor air and indoor air in homes with unvented gas appliances. A prospective cohort study was carried out to test the hypothesis that residential exposure to N02 increases incidence and severity of respiratory illnesses during the first 18 months of life. A cohort of 1,205 healthy infants from homes without smokers was enrolled. The daily occurrence of respiratory symptoms and illnesses was reported by the mothers every 2 wk. Illnesses with wheezing or wet cough were classified as lower respiratory tract. Indoor N02 concentrations were serially measured with passive samplers place in the subjects' bedrooms. In stratified analyses, illness incidence rates did not consistently increase with exposure to N02 or stove type. In multivariate analyses that adjusted for potential confounding factors, odds ratios were not significantly elevated for current or lagged N02 exposures, or stove type. Illness duration, a measure of illness severity, was not associated with N02 exposure. The findings can be extended to homes with gas stoves in regions of the United States where the outdoor air is not heavily polluted by N02.

Samet, J.M., Lambert, W.E., Skipper, B.J., Cushing, A.H., Hunt, W.C., Young, S.A., McLaren, L.C., Schwab, M., & Spengler, J.D. (1993). **Nitrogen dioxide and respiratory illness in children. Part 1: Health outcomes.** *Res Rep Health Eff Inst* (58):1-32; discussion 51-80.

We have carried out a prospective cohort study to test the hypothesis that exposure to nitrogen dioxide increases the incidence and severity of respiratory infections during the first 18 months of life.

Between January 1988 and June 1990, 1,315 infants were enrolled into the study at birth and followed with prospective surveillance for the occurrence of respiratory infections and monitoring of nitrogen dioxide concentrations in their homes. The subjects were healthy infants from homes without smokers; they were selected with stratification by type of cooking stove at a ratio of four to one for gas and electric stoves. Illness experience was monitored by a daily diary of symptoms completed by the mother and a telephone interview conducted every two weeks. Illnesses with wheezing or wet cough were classified as involving the lower respiratory tract; 0 other respiratory illnesses were designated as involving the upper respiratory tract. Exposure to nitrogen dioxide was estimated by two-week average concentrations measured in the subjects' bedrooms with passive samplers. This analysis is limited to the 1,205 subjects completing at least one month of observation; of these, 823 completed the full protocol, contributing 82.8% of the total number of days during which the subjects were under observation. Incidence rates for all respiratory illnesses, all upper respiratory illness, all lower respiratory illnesses, and lower respiratory illness further divided into those with any wheezing, or wet cough without wheezing, were examined within strata of nitrogen dioxide exposure at the time of the illness, nitrogen dioxide exposure during the prior month, and type of cooking stove. Consistent trends of increasing illness incidence rates with increasing exposure to nitrogen dioxide were not evident for either the lagged or unlagged exposure variables. The effect of nitrogen dioxide exposure on illness occurrence during at-risk intervals of two weeks'duration was examined using the generalized estimating equation approach. In these multivariate analyses, none of the odds ratios was significantly elevated for unlagged nitrogen dioxide exposures, lagged nitrogen dioxide exposures, or stove type. Duration of illness was assessed in relation to the same exposure variables; illness duration and nitrogen dioxide exposure were not associated. We have found that indoor exposure to nitrogen dioxide is associated with neither the incidence nor the duration of respiratory illnesses. The study was designed to have sufficient power to detect effects of nitrogen dioxide exposure of magnitudes previously reported and in a range relevant to public health concern; the lack of association cannot be attributed to potential bias from misclassification of outcome or exposure. (ABSTRACT TRUNCATED AT 400 WORDS)

Samet, J.M., Smith, K.R., & Romeiu, I. (1997). **Air Pollution and Childhood ARI:** a Review. In B. Kirkwood, et al. (Eds.), *Interventions to Reduce Morbidity and Mortalityfrom Pneumonia in Children.* London: London School of Hygiene and Tropical Medicine (forthcoming).

Sandoval, J., Salas, J., Martinez-Guerra, M.L, Gomez, A., Martinez, C., Portales, A., Palomar, A., Villegas, M., & Barrios, R. (1993). **Pulmonary arterial hypertension and cor pulmonale associated with chronic domestic woodsmoke inhalation.** *Chest* 103(l):12-20.

We describe the clinical, radiologic, functional, and pulmonary hemodynarnic characteristics of a group of 30 nonsmoking patients with a lung disease that may be related to intense, long-standing indoor wood-smoke exposure. The endoscopic and some of the pathologic findings are also presented. Intense and prolonged wood-smoke inhalation may produce a chronic pulmonary disease that is similar in many aspects to other forms of inorganic dust-exposure interstitial lung disease. It affects mostly country women in their 60s, and severe dyspnea and cough are the outstanding complaints. The chest roentgenograms show a diffuse, bilateral, reticulonodular pattern, combined with normalized or hyperinflated lungs, as well as indirect signs of pulmonary arterial hypertension (PAH). On the pulmonary function test the patients show a mixed restrictive-obstructive pattern with severe hypoxernia and variable degrees of hypercapnia. Endoscopic findings are those of acute and chronic bronchitis and intense anthracotic staining of the airways appears to be quite characteristic. Fibrous and inflammatory focal thickening of the alveolar septa as well as diffuse parenchymal anthracotic deposits are the most prominent pathologic findings, although inflammatory changes of the bronchial epithelium are also present. The patients had severe PAH in which, as in other chronic lung diseases, chronic alveolar hypoxia may play the main pathogenetic role. However, PAH in wood-smoke inhalation-associated lung disease (WSLkLD) appears to be more severe than in other forms of interstitial

lung disease and tobacco-related COPD. The patients we studied are a selected group and they may represent one end of the spectrum of the WSLALD.

Schwartz, J., Dockery, D.W., Neas, L.M., Wypij, D., Ware, J.H., Spengler, J.D., Koutrakis, P., Speizer, F.E., & Ferris, B.G., Jr. (1994). **Acute effects of summer air pollution on respiratory symptom reporting in children.** *Am J Respir Crit Care Med* 150(5 Pt 1):1234-42.

A daily diary of respiratory symptoms was collected from the parents of 1,844 school children in six U.S. cities to study the association between ambient air pollution exposures and respiratory illness. A cohort of approximately 300 elementary school children in each of six communities were asked to keep a daily log of the study child's respiratory symptoms for one year. Daily measurements of ambient sulfur dioxide, nitrogen dioxide, ozone, inhalable particles (PM10), respirable particles (PM2.5), light scattering, and sulfate particles were made, along with integrated 24-h measures of aerosol strong acidity. The analyses were limited to the five wann season months between April and August. Significant associations were found between incidence of coughing symptoms and incidence of lower respiratory symptoms and PM10, and a marginally significant association between upper respiratory symptoms and PM10. There was no evidence that other measures of particulate pollution including aerosol acidity were preferable to PM10 in predicting incidence of respiratory symptoms. Significant associations in single pollutant models were also found between sulfur dioxide or ozone and incidence of cough, and between sulfur dioxide and incidence of lower respiratory symptoms.

Schwartz, J. (1994). **What are people dying of on high air pollution days?** *Environ Res* 64(l):26-35.

The air pollution disasters in London in 1952, the Meuse valley in 1930, and in Donoroa, Pennsylvania, in 1948 made it clear that extremely high levels of particulate-based smog could produce large increases in the daily mortality rate. Recent studies of fluctuations in daily air pollution and daily mortality have reported associations at much lower concentrations in London during the 1960s and in Philadelphia, Steubenville, Santa Clara, St. Louis, Utah valley, Detroit, and eastern Tennessee in the 1970s and 1980s. Whether these associations are causal or not is a matter of considerable public health concern. If the detailed pattern of the deaths at these lower concentrations appeared similar to the pattern in London, this would strengthen the argument for causality. To examine this issue, the death certificates from Philadelphia were examined on the 5% of the days with the highest particulate air pollution and the 5% of the days with the lowest particulate air pollution during the years 1973-1980. There was little difference in weather between the high and low pollution days, but total suspended particulate matter concentrations averaged 141 micrograms/m3 on the high pollution days versus 47 micrograms/m3 on the low pollution days. The relative risk of dying on the high pollution days was 1.08 $P < 0.000$ 1. The relative increase was higher for COPI) (1.25) and pneumonia (1. 13). Deaths were also elevated for heart disease and stroke; however, there was a substantial increase in the reports of respiratory factors as contributing causes for those underlying causes of death. Dead-on-arrival deaths and deaths outside of hospitals and clinics were also disproportionately increased. This paralleled the pattern seen in London in 1952. The age pattern of the relative risk of death was also similar. This adds to the evidence that the association is causal.

Schwartz, J., Dockery, D.W., & Neas, L.M. (1996). **Is daily mortality associated specifically with fine particles?** *J Air Waste Manag Assoc* 46(10):927-39.

Recent epiderniologic studies have consistently reported increased daily mortality associated with exposures to particulate air pollution. Currently, particulate mass is measured as particles smaller than 10 microns (PM10). Fine (PM2.5) and coarse (PM10-PM2.5) mass and sulfate particle concentrations were measured in six eastern U.S. cities for eight years, and aerosol acidity concentrations were measured for approximately one year. Daily mortality for these metropolitan areas was combined with particulate air pollution and weather measurements. City-specific associations with each measure of particle pollution were estimated by Poisson regression, adjusting for time trends and weather by nonparametric methods. Combined

effect estimates were calculated as the inverse variance weighted mean of the city-specific estimates. PM10, PM2.5, and S04= were each significantly associated with increased daily mortality, while no associations were found with coarse mass nor with aerosol acidity (H+) concentrations. The strongest association was found with PM2.5. A 10 micrograms1m3 increase in two-day mean PM2.5 was associated with a 1.5% (95% Cl 1. 1 % to 1.9%) increase in total daily mortality. Somewhat larger increases were found for deaths caused by chronic obstructive pulmonary disease (+3.3%) and by ischemic heart disease (+2. 1 %). These data suggest that increased daily mortality is specifically associated with particle mass constituents found in the aerodynamic diameter size range under 2.5 microns, that is, with combustion-related particles.

Seligal, S. (1993). **Pneumocystis pneumonia: a time to shed complacence [editorial; comment].** *J Assoc Physicians India* 41(1):5-7.

Selgrade, M., & Gilmour, M. (1994). Effects of **gaseous air pollutants on immune responses and susceptibility to infectious and allergic disease.** In J. Dean, M. Luster, A. Munson, & I. Kimber (Eds.), *Immunotoxicology and Immunopharmacology* (Second ed., pp. 395-411). New York: Raven Press, Ltd.

Shah, N., Ramankutty, V., Pren-dla, P.G., & Sathy, N. (1994). **Risk factors for severe pneumonia in children in south Kerala: a hospital-based case-control study.** *J Trop Pediatr* 40(4):201-6.

A case-control study was undertaken in 400 children under 5 years of age in South Kerala, India, to identify the risk factors for severe pneumonia. Cases were in-patients with severe pneumonia as ascertained by WHO criteria, while controls were out-patients with non-severe acute respiratory infections. Only four from many probable risk factors emerged as being significant, viz. young age, immunization, delayed weaning, and sharing of bedroom. The significant factors on univariate analysis were parental education, environmental pollution, discontinuation of breastfeeding in young infants, malnutrition, hypovitaminosis A, low birth weight previous history of severe ARI, unresponsiveness to earlier treatment, and use of nonallopathic medicine. Correction of these factors can probably reduce mortality due to ARI.

Smith, K.R. (1987). **Biofuels, air pollution, and health:** a global review. New York: Plenum Press.

Smith, K.R. (1990). Health effects in developing countries. In J. Paszter & L. Kristoferson (Eds.), *Bioenergy and Environment (pp.* 301-322). Boulder, CO: Westview.

Smith, KR, ed., (1992). **Epidemiological, Social and Technical Aspects** of Air **Pollution from Biomass Fuel** (Report of a WHO Consultation WHO/PEP/923A). Geneva: World Health Organization.

Smith, K.R. (1993). **Fuel combustion, air pollution exposure, and health: the situation in developing countries.** *Ann Rev Environ Energy* 18:529-566.

Smith, K.R. (1994). **The health impact of cookstove smoke in Africa.** In H. Research Group on African Development Perspectives Bremen: Bass, J. Franz, E. Grawert, W. Hein, R. Kappel, F. Messner, J. Pohlan, & K. Wohlmuth (Eds.), *African Development Perspectives Yeabook 199211993: Energy and Sustainable Development* (Vol. 3, pp. 417-434). Hamburg: Lit Verlag.

Smith, K.R. (1996). **Indoor air pollution in India [editorial].** *Natl Med J India* 9(3):103-4.

Smith, K.R. (1996). **Indoor air pollution in developing countries: growing evidence of its role in the global burden of disease.** In K. Ikeda & T. Iwata (Eds.), *Indoor Air '96: The 7th International Conference on Indoor Air Quality and Climate* (Vol. 3, pp. 33-44). Tokyo: Institute of Public Health.

Sobral, H.R. (1989). **Air pollution and respiratory diseases in children in Sao Paulo, Brazil.** *Soc Sci Med* 29(8):959-64.

Air pollution in the huge conurbation of Sao Paulo, Brazil *(13* million inhabitants) has been mapped from air quality monitoring stations. In three contrasted sample areas, children's respiratory health parameters were collected to assess the roles of poverty and poor housing against those of air pollution. Respiratory ill-health is clearly shown to vary with pollution levels and there is evidence that socio-economic conditions aggravate the problem.

Sofoluwe, G.O. (1968). **Smoke pollution in dwellings of infants with bronchopneumonia.** *Arch Environ Health* 16(5):670-2.

Sram, R.J., Benes, I., Binkova, B., Dejmek, J., Horstman, D., Kotesovec, F., Otto, D., Perreault, S.D., Rubes, J., Selevan, S.G., Skalik, I., Stevens, R.K., & Lewtas, J. (1996). **Teplice program—the impact of air pollution on human health.** *Environ Health Perspect* 104 (Suppl 4):699-714.

The aim of the Teplice Program is to investigate and assess the impact of air pollution on the health of the population in the district of Teplice, Czech Republic. Characterization of the air pollutants demonstrated unusually high concentrations during winter inversions of fine particles dominated by acidic sulfates, genotoxic organic compounds, and toxic trace elements. The major source of airborne fine particles is the burning of coal for heating and power. Human exposure and biornarker studies demonstrated large seasonal variations in air pollution within the Teplice District and higher seasonal average pollution levels than the comparative district, Prachatice. Personal exposures to fine particles and organic carcinogens [e.g., polycyclic aromatic hydrocarbons (PAH)l were correlated with excretion of PAH metabolites in urine, several trace metals in blood, and DNA adducts in white blood cells. Respiratory and neurobehavioral studies of school children were conducted using questionnaires and clinical measures. A significantly higher prevalence of adverse respiratory symptoms and decreased lung function were found in the Teplice district than in Prachatice. The neurobehavioral studies indicated significantly higher teacher referrals for clinical assessment in Teplice, but the majority of objective performance measures did not differ. Reproductive studies were conducted in both males and females. A study of the effects of exposure on pregnancy and birth found an excess prevalence of low birth weight and premature births in Teplice; these adverse effects were more common in infants conceived in the winter and whose mothers were smokers. Based on questionnaires and medical examination, the reproductive development of young men was not different between districts and seasons, however, measures of semen quality suggest that exposure to high levels of air pollution are associated with transient decrements in semen quality.

Stansfield, S., & Shepard, D. (1993). **Acute respiratory infection.** In D. Jameson, W. Mosley, A. Measham, & J. Bobadilla (Eds.), *Disease Control Priorities in Developing Countries (pp. 67-90):* Oxford University Press.

Sterling, T.D., Rosenbaum, W.L., & Weinkam, J.J. *(1995).* Re: **"Concentration of indoor particulate matter as a determinant of respiratory health in children" [letter; comment].** *Am J Epidemiol* 141(6):581-2.

Stem, B.R., Raizenne, M.E., Burnett, R.T., Jones, L, Kearney, J., & Franklin, C.A. (1994). **Air pollution and childhood respiratory health: exposure to sulfate and ozone in 10 Canadian rural communities.** *Environ Res* 66(2):125-42.

This study was designed to examine differences in the respiratory health status of preadolescent school children, aged *7-11* years, who resided in 10 rural Canadian communities areas of moderate and low exposure to regional sulfate and ozone pollution. Five of the communities were located in central Saskatchewan, a low-exposure region, and five were located in southwestern Ontario, an area with moderately elevated exposures resulting from long-range atmospheric transport of polluted air masses. In this cross-sectional study, the child's respiratory symptoms and illness history were evaluated using a parent-completed questionnaire, administered in September 1985. Respiratory function was assessed once for each child in the schools between October 1985 and March 1986, by the measurement of pulmonary function for forced vital capacity (FVC), forced expiratory volume in I sec (FEV1.0), peak expiratory flow rate (PEFR), mean forced expiratory flow rate during the middle half of the FVC curve (FEF25-75), and maximal expiratory flow at 50% of the expired vital capacity (V50max).1be 1986 annual mean of the 1-hr daily maxima of ozone was higher in Ontario (46.3 ppb) than in Saskatchewan (34.1 ppb), with 90th percentile concentrations of 80 ppb in Ontario and 47 ppb in Saskatchewan. Summertime 1-hr daily maxima tneans were 69.0 ppb in Ontario and 36.1 ppb in Saskatchewan. Annual mean and 90th percentile concentrations of inhalable sulfates were three times higher in Ontario than in Saskatchewan; there were no significant differences in levels of inhalable particles (PM10) or particulate nitrates. Levels of sulfur dioxide (S02) and nitrogen dioxide (N02) were low in both regions. After controlling for the effects of age, sex, parental smoking, parental education, and gas cooking, no significant regional differences were observed in rates of chronic cough or phlegm, persistent wheeze, current asthma, bronchitis in the past year, or any chest illness that kept the child at home for 3 or more consecutive days during the previous year. Children living in southwestern Ontario had statistically significant ($P < 0.01$) mean decrements of 1.7% in FVC and 1.3% in FEV1.0 compared with Saskatchewan children, after adjusting for age, sex, weight, standing height, parental smoking, and gas cooking. There were no statistically significant regional differences in the pulmonary flow parameters ($P > 0.05$).

SurJadi, C. (1993). **Respiratory diseases of mothers and children and environmental factors among households in Jakarta.** *Environment and Urbanization* 5(2):78-86.

Tatotschenko, W.K, & Nesterenko, S.W. (1990). **[Effect of moderate pollutant concentrations in the air and incidence of respiratory diseases in children].** *Z Erkr Atmungsorgane* 174(3):185-9.

In an industrial region respiratory morbidity of children was studied in 3 localities with different levels of air pollution within maximal permissible concentrations (average monthly S02 0.35 mg/m3, 0.25 mg/m3 and less than 0.15 mg/m3 and correlating concentrations of CO, N02 and particles). It was shown that acute respiratory morbidity and prevalence of recurrent bronchitis did not correlate with S02 level and was highest in a big city. There was however a correlation with S02 level of bronchial asthma prevalence (3.0, 2.7 and 2.1), as well as morbidity with acute bronchitis (45.1, 23.3 and 10.6) and acute obstructive bronchitis (15.0, 5.4 and 2.4)—all figures per 1,000 children. Daily acute respiratory morbidity also did not correlate with peaks of S02 during 3 preceding days, but acute bronchitis correlated with such peaks 2 days before ($r = +0.5$). Passive smoking and stove heating were significantly more frequent in families of children with respiratory complaints as compared to those without such complaints. Since these differences were more pronounced in industrial towns than in rural areas, it well may be that industrial pollutants potentiate or aggravate the effect of indoor air pollution.

Terblanche, P., Nel, R., & Golding, T. (1994). **Household energy sources in South Africa - an overview of the impact of air pollution on human health.** Pretoria: CSIR Environmental Services, Department of Mineral and Energy Affairs and EMSA (Pty) Ltd.

Terblanche, A.P., Opperman, L., Nel, C.M., Reinach, S.G., Tosen, G., & Cadman, A. (1992). **Preliminary results of exposure measurements and health effects of the Vaal Triangle Air Pollution Health Study.** *S afr Med J* 81(11):5506.

The aim of the Vaal Triangle Air Pollution Health Study is to assess the adequacy of South Africa's air pollution control programme to protect human health. It is a longitudinal study of children aged 8-12 years which will evaluate exposure and effects of outdoor and indoor air pollution levels on the health of more than 10,000 white and black children living in Vanderbijlpark, Sasolburg, Vereeniging, Meyerton, Randvaal, and the Sebokeng/Sharpeville areas (Lekoa), Transvaal, RSA. Extensive data on outdoor and indoor levels of air pollution as well as personal exposures to total suspended particulate matter were collected. Preliminary results indicate that the levels of particulate matter exceed the USA health standards. A health questionnaire administered to 10, 187 white children indicated that during the past year 65.9% had suffered from upper respiratory tract illnesses (URI) such as sinusitis, rhinitis and hay fever and 28.9% from lower respiratory tract illnesses (LRI) such as bronchitis, chronic cough and chronic chest illnesses. Parents who perceived that the air pollution in the region is serious had a higher reporting rate of URI/LRI for their children than parents who considered the air pollution not to be serious (77.4% v. 56.8% respectively for URI and 24.1% v. 16.3% respectively for LRI). The effect of this recall bias will be evaluated in later analyses. A statistically significant higher prevalence of LRI was reported in children exposed to parental smoking (25.7% for households where both parents smoked v. 20.8% in households without parental smoking) (odds ratio (OR) 1.32 (1.2-1.5)).

Turnwesigire, S.G., & Barton, T. (1995). **Environmental risk factors for acute respiratory infections among children of military personnel in Uganda.** *East Afr Med J* 72(5):290-4.

A community-based, cross-sectional survey was done in five Army camps in the central area of Uganda to explore relationships between environmental household conditions and the presence or absence of acute respiratory infections. A total sample of 122 homes with 152 children of both sexes were studied. Each child was medically examined and diagnosis recorded. A check-list was filled out for each household that had at least one child aged 5 years or less; the list recorded conditions of crowding, roofing materials, house ventilation, cooking fuels and cooking place, family income and immunization status. Cross-tabulation tables were prepared and Chi-square values calculated for the various forms of ARI and environmental characteristics. Significance level was put at 5% ($p = < 0.05$). Using standard tables, significant associations were found between ARI diagnosed at the examination of a child and the following: number of persons per house (p 0.01); bed sharing ($p = 0.027$); house ventilation ($p = > 0.01$) and; presence or absence of a smoke vent in a house (p 0.002). Crowding and increased indoor air-pollution were rife in Ugandan Army camps and seem to have contributed to the local incidence of ARI in children. It is recommended that health education activities be started to promote improved environmental sanitation and to reduce crowding. Simple smoke vents should be installed over fireplaces to reduce indoor air pollution. The use of gas or electricity as cleaner cooking fuels and making better constructed houses are preferable strategies but both are not likely to be achieved at the moment.

Tuthill, R.W. (1984). **Woodstoves, formaldehyde, and respiratory disease.** *Am J Epidemiol* 120(6):952-5.

Telephone interviews were completed in Western Massachusetts in April 1983 for 399 households (91.5 per cent) in a random sample of households with elementary school children. Woodstoves were used in 64.7 per cent of the homes, but such use was not associated with acute respiratory illness. However, formaldehyde exposure was significantly related, with a risk ratio of 2.4 (95 per cent confidence interval 1.7-

3.4). New construction/remodeling and new upholstered furniture had additive effects. Neither woodstove use nor formaldehyde exposure were significantly associated with asthma, chronic bronchitis, or allergies.

Utell, M.J., & Samet, J.M. (1993). **Particulate air pollution and health. New evidence on an old problem [editorial; comment].** *Am Rev Respir Dis* 147(6 Pt 1):1334-5.

van Ginneken, J. (1989). **Behavioral factors affecting transmission and treatment of acute respiratory infections.** In J. Caldwell, S. Findley, P. Caldwell, G. Santow, W. Cosford, J. Braid, & D. Broers-Freeman (Eds.), *What We Know about Health Transition: The Cultural, Social and Behavioral Determinants o Health* (Vol. 2, pp. 843-865). Canberra.

Verma, B.K, & Tbakur, D.K. (1995). **Effect of stressful environmental factors upon neonatal immune system.** *Cent Eur J Public Health* 3(1):25-9.

To examine the effects of stressful environmental conditions upon the immune system of the newborn (neonates), we analyzed the neonatal serum immunoglobulin levels in a total of 67 neonates from tribal families living in a rural community of eastern India. These cases were grouped into three categories, based upon the predominance of one of the three factors being analyzed, and the reasonable absence of the other two factors. The three factors as determined by the prevailing environmental conditions, which were the basis for fonning the three groups, were: 1. indoor air pollution; 2. hygienic conditions, and 3. the cohabitation of domesticated animals in the sarne household as the infants's families. Presence of indoor air pollution or unhygienic conditions resulted in the disturbance and depression of the levels of serum immunoglobulins; of different classes. There was no discernible correlation found between the levels of inummoglobulins of different classes from the neonates (except IgM) and the cohabitation of domesticated animals in the same households. However the incidence of GIT and RT infections was higher in all the three experimental groups, as compared to the control group. These results suggest that unfavorable environmental conditions can adversely affect the immune system at neonatal stages, and can increase their susceptibility to subsequent acute or chronic events.

Viegi, G., Paoletti, P., Carrozzi, L., Vellutini, M., Ballerin, L., Biavati, P., Nardini, G., Di Pede, F., Sapigni, T., Lebowitz, M.D., & et al. (1991). **Effects of home environment on respiratory symptoms and lung function in a general population sample in north Italy.** *Eur Respir J* 4(5):580-6.

Effects of indoor pollution exposure were evaluated in a general population sample (n = 3,289) living in the Po River Delta area. Prevalence rates of chronic cough in men and dyspnoea in women were significantly higher in association with the use of bottled gas (propane) for cooking instead of natural gas (methane). Chronic cough and phlegm in men and dyspnoea in women were significantly associated with the use of a stove for heating. When combining type of heating and fuel used, in men a trend toward higher prevalence rates of chronic cough and phlegm was shown in those with stove or fan heating (regardless of the fuel); in women the trend reached statistical significance for dyspnoea. The relationship between stove (regardless of fuel) and decrease in forced expirograms was statistically significant only in women. In multiple logistic models, accounting for independent effects of age, smoking, pack-years, parents' smoking, socio-economic status, body mass index, significantly increased odds ratios were found in males for the associations of. bottled gas for cooking with cough (1.66) and dyspnoea (1.8 1); stove for heating with cough (1.44) and phlegm (1.39); stove fuelled by natural gas and fan or stove fuelled other than by natural gas with cough (1.54 and 1.66). In females, significantly increased odds ratios were found only for dyspnoea when associated with bottled gas for cooking (1.45), stove for heating (1.46), stove fuelled by natural gas (1.58), stove or fan fuelled other than by natural gas (1.73).

Viegi, G., Carrozzi, L., Paoletti, P., Vellutini, M., DiViggiano, E., Baldacci, S., Modena, P., Pedreschi, M., Mammini, U., di Pede, C., & et al. (1992). **Effects of the home environment on respiratory symptoms of a general population sample in middle Italy.** *Arch Environ Health* 47(l):64-70.

The effects of home environment characteristics were evaluated in a multistage, stratified, cluster sample (N 3,866) of the general population who lived in the district of Pisa (middle Italy). Each subject completed a standardized interviewer-administered questionnaire that contained questions about respiratory symptoms/diseases and risk factors (e.g., type of heating, fuels used for cooking and heating). Cough and asthma were significantly more frequent in men who did not smoke and who did not use natural gas for cooking and heating. Attacks of shortness of breath accompanied by wheeze, dyspnea, and cardiovascular conditions in female nonsmokers were associated with use of a stove or forced-air circulation for heating; the type of fuel used did not affect this result. Multiple logistic models, which accounted for independent effects of age, smoking status, pack-years, childhood respiratory illness, education, zone of residence, and work exposure to dusts, chemicals, or ftimes, showed significantly increased odds ratios for (a) cough and phlegm in males (associated with bottled gas for cooking), (b) wheeze and shortness of breath with wheeze in females (associated with the use of a stove or forced-air circulation). These results, which confirm our previous observations in an unpolluted rural area of north Italy, indicate that characteristics of the home environment, as assessed by questionnaire, may be linked to mild adverse health effects, i.e., respiratory symptoms, in the general population. The results also identify the need to better characterize the dose-response relationship in indoor air pollution monitoring studies that include subsamples of this population.

Volkmer, R.E., Ruffin, R.E., Wigg, N.R., & Davies, N. (1995). **The prevalence of respiratory symptoms in South Australian preschool children. H. Factors associated with indoor air quality.** *J Paediatr Child Health* 31(2):116-20.

OBJEC71VE: This study investigated the relationship between indoor air quality and the prevalence of respiratory symptoms in South Australian preschool children. METHODOLOGY: Data were collected from 14,124 families with a child aged 4 years 3 months to 5 years of age. Tlus sample represents 73 % of the targeted State preschool population. At the time of a routine preschool health check, parents completed a questionnaire regarding: their child's respiratory health and place of residence (postcode), parental smoking, type of fuel used for cooking and heating and method used for home cooling. RESULTS: For preschool children residing in the greater Adelaide region, logistic regression analyses found that having a natural gas stove compared to an electric stove was significantly associated with increased prevalence rates for: (i) asthma (odds ratio [OR] 1.24); (ii) wheezing in the preceding 12 months (OR 1. 16); excessive colds (OR 1. 14); and hay fever (OR 1. 13). The use of a liquid petroleum gas stove compared to an electric stove was not associated with any respiratory symptoms. The use of a flueless gas heater compared to other forms of heating was significantly associated with increased prevalence rates for dry cough (OR 1.26), ever having wheezed (OR 1. 15) and wheezing in the preceding 12 months (OR 1.18). The use of a wood firetheater compared to other forms of heating was significantly associated with a reduced prevalence rate for dry cough (OR 0.84) and ever having wheezed (OR 0.82). Parental smoking was significantly associated with increased prevalence rates for bronchitis (OR 1.21) and ever having wheezed (OR 1.24). The form of home cooling used was not associated with prevalence rates, after accounting for geographic location. Socio-economic status (postcode level) was not generally associated with prevalence rates. CONCLUSIONS: These results suggest that respiratory symptom prevalence is related to the fuel used for cooking and heating and parental smoking. Prospective investigation regarding indoor air quality and respiratory symptoms is required.

von Schirnding, Y.E. (1992). **Environmental health issues in the 1990s [editorial].** *S afr Med J* 81(11):536-7.

Wafula, E.M., Onyango, F.E., Thairu, H., Boleij, J.S., Hoek, F., Ruigewaard, P., Kagwanja, S., De Koning, H., Pio, Kimani, E., & et al. (1990). **Indoor air pollution in a Kenyan village.** *East Afr Med J* 67(1):24-32.

In April 1986, a study was carried out within rural households in Maragua area, Muranga District, Republic of Kenya, to assess the degree of indoor air pollution and to find its relationship, if any, to acute respiratory infections (ARI) among children aged below 5 years within the study. This study was carried out within an ongoing aetiological and epidemiological community study on ARI as a collaborative effort between the Department of Paediatrics, University of Nairobi; the Department of Chemistry, Kenyatta University; the Department of Environmental Sciences, Agricultural University, Wagenigen, The Netherlands; the World Health Organization; and the Ministry of Health, Republic of Kenya. Repeated 24 hour measurements of respirable suspended particles (RSP) and nitrogen dioxide (N02), were carried out in 36 randomly selected houses where most of the cooking was done on open fires using firewood and crop residues as fuel. Data on house characteristics and activity in the study were gathered by questionnaire. The mean of 24 hour average RSP concentration (1400ingtin3), average during the 7 hours of daily burning (3000-4000mg/m3), and evening peak levels (up to 3600mg/m3) indicate that deleterious health effects due to exposure to excessive levels of toxic pollutants in smoke from biomass combustion are likely to occur especially among pre-school children and women. Concentrations of selected polycyclic hydrocarbons in the particulate material were found to be high. It was not possible to demonstrate a relationship between the indoor air pollution and episodes of ARI partly because of small sample size and also the more or less homogeneous nature of pollution among all the households.

Wang, X., Ding, H., Ryan, L., & Xu, X. (1997). **Association between air pollution and low birth weight: a community-based study.** *Environmental Health Perspectives* 105(5):514-520.

The relationship between maternal exposure to air pollution during periods of pregnancy (entire and specific periods) and birth weight was investigated in a well-defined cohort. Between 1988 and 1991, all pregnant women living in four residential areas of Beijing were registered and followed from early pregnancy unitl delivery. Information on individual mothers and infan6s was collected. Daily air pollution data were obtained independently. Multiple linear regression and logistic regression were used to estimate the effects of air pollution on birth weight and low birth weight (<2,500 g), adjusting for gestational age, residence, maternal age, year of birth, and infant gender. There was a significant exposure-response relationship between maternal exposure to sulfur-dioxide (S02) and total suspended particulates (TSP) during the third trimester of pregnancy and birth weight. The adjusted odds ratio for low birth weight was 1.11 (95% Cl, 1.06-1.16) for each 100 ug1m3 increase in S02 and 1. 10 (95% Cl, 1.05-1.14) for each 100 ug1m3 increase in TSP. The estimated reduction in birth weight was 7.3 g and 6.9 g for each 100 ug/m3 increase in S02 and TSP, respectiviely.

Wesley, A.G., & Loening, W.E. (1996). **Assessment and 2-year follow-up of some factors associated with severity of respiratory infections in early childhood.** *S Afr Med J* 86(4):365-8.

OBJEC'rTVE: To assess the effect of some factors on the severity of acute respiratory infection (ARI) in children. DESIGN: In a case control study, children with pneumonia were matched with controls who had upper respiratory infection. They were compared in respect of nutrition, household crowding and smoke pollution, and the presence of current viral respiratory infmtion. Both cohorts were followed up for 18-24 months to determine if there was a difference in subsequent respiratory sequelae. SETTING: Primary health care-based cohorts of peri-urban township children. PARTICIPANTS: Forty-eight children < 3 years of age with pneumonia (index cases) were matched by age and presentation time with controls who suffered only from upper respiratory infection. All came from underprivileged communities. Index cases were selected as they presented and the study was conducted between February 1988 and June 1991. MAIN OUTCOME MEASURE: Any difference between index cases and controls in respect of the four factors listed under'Design'. Follow-up home visits determined whether subsequent sequelae of the two grades of ARI

were different. RESULTS: The presence of current viral infection at entry to the study was evident in 21 of those with pneumonia and 12 controls (difference between groups = 19.15%,95% confidence intervals 0.25 - 38.05, P = 0.052). Overcrowding in the home was comparable. Index homes were occupied by a mean of 3.57 (SD 1.54) children and 5.26 (SD 4.84) adults, control homes by 3.51 (SD 1.80) children and 4.36 (SD 2.02) adults. Occupancy of the room in which the child slept was also not significantly different: index group mean 4.23 (SD 1.55) and controls 4.02 (SD 1.38) (mean difference 0.21, 95% Cl 0.378 - 0.798, P = 0.485). Correlation of bedroom crowding with young age (< I year) or weight-for-age centiles was not significant in either cohort (r < 0.3 in all). The prevalence of viral infection was not increased by degree of crowding in either group (P = 0.636). Domestic smoke pollution was similar: cigarette smoking occurred in 75% of index homes and 69% of control homes. Wood or coal fires were used in 19% of index and 14% of control homes. The nutritional status of both groups proved to be similar. Fifteen per cent of index children and 12% of controls had weight-for-age centiles < or = 10th centile (difference = 3.26%, 95% C1 10.72 - 17.24, P = 0.649). Two-year home follow-up visits were completed in 75% of the index and 69% of the control group. The balance were followed up for 18 months. There was no difference between index and control children in the recurrence of respiratory symptoms (P = 0.664) or need to visit a health facility (P = 0.302). CONCLUSIONS: Factors shown elsewhere to contribute to the acquisition or severity of ARI could not be demonstrated as important in this study. The children with pneumonia and their matched controls with upper respiratory infections came from equally overcrowded and smoke-filled homes, had comparable nutritional status which was not markedly poor, and had an equal incidence of current viral infection. Subsequent ill-health was not found to be greater in the pneumonia group.

WHO. (1987). **Indoor air pollution study: Maragua, Kenya** (WHO/PEP/87.1). Geneva: World Health Organization.

Wichmann, H.E., & Heinrich, J. (1995). **Health effects of high level exposure to traditional pollutants in East Germany—review and ongoing research.** *Environ Health Perspect* 103 (Suppl 2):29-35.

In East Germany ambient air pollution is characterized by high concentrations of sulfur dioxide (S02) and suspended particulates (SP). Since acidity and sulfate are surprisingly low, oxidation of S02 seems to be incomplete and neutralization seems to play an important role. Few studies on health effects of air pollution in the former German Democratic Republic have been performned. They showed an increased prevalence in polluted areas of respiratory symptoms, lung function decrement, mild anernia, nonspecific stimulation of the immune system and, retardation of skeletal maturation of children. Since the German unification in 1990, several large-scale studies have been started. Short-term effects of air pollution on daily mortality have been investigated in Erfurt retrospectively for 1980 to 1989. Logarithmic exposure-effect curves have been found for both S02 and SP. The number of deaths increased by about 10% with S02 and by more than 20% with SP if the 95th percentile of the pollutant is compared to the 5th percentile. 'Me logarithmic shape shows that the increase of ambient concentrations at the beginning of the heating season in fall is more important than further increases in concentrations later in winter. A second study on short-term effects was conducted using daily peak flow measurements and respiratory symptoms in 270 patients with asthma and other obstructive airway diseases in East Germany and the Czech Republic between 1990 and 1992. From regression analysis it follows that an increase by 500 micrograms/m3 of S02 leads to a mean decrease of the average patient's peak flow below 2%.

Woodruff, T.J., Grillo, J., & Schoendorf, K.C. (1997). **The relationship between selected causes of postneonatal infant mortality and particulate air pollution in the United States.** *Environ Health Perspect* 105(6):608-12.

Recent studies have found associations between particulate air pollution and total and adult mortality. The relationship between particulate air pollution and mortality among infants has not been examined in the

United States. This study evaluates the relationship between postneonatal infant mortality and particulate matter in the United States. Our study involved analysis of cohorts consisting of approximately 4 million infants bom between 1989 and 1991 in states that report relevant covariates; this included 86 metropolitan statistical areas (MSAs) in the United States. Data from the National Center for Health Statistics-linked birtb/infant death records were combined at the MSA level with measurements of particulate matter 10 microns or less (PMl0) from the EPA's Aerometric Database. Infants were categorized as having high, medium, or low exposures based on tertiles of PM 10. Total and cause-specific postneonatal mortality rates were examined using logistic regression to control for demographic and environmental factors. Overall postneonatal mortality rates were 3.1 among infants with low PM 10 exposures, 3.5 among infants with medium PM 10 exposures, and 3.7 among highly exposed infants. After adjustment for other covariates, the odds ratio (OR) and 95% confidence intervals (CI) for total postneonatal mortality for the high exposure versus the low exposure group was 1. 10 (1.04, 1.16). In normal birth weight infants, high PM10 exposure was associated with respiratory causes [OR = 1.40, (1.05, 1.85)] and sudden infant death syndrome [OR = 1.26, (1.14, 1.39)]. For low birth weight babies, high PM10 exposure was associated, but not significantly, with mortality from respiratory causes [OR = 1. 18, (0.86, 1.6 1)]. This study suggests that particulate matter is associated with risk of postneonatal mortality. Continued attention should be paid to air quality to ensure optimal health of infants in the United States.

Woodward, A., Douglas, R.M., Graham, N.M., & Miles, H. (1990). **Acute respiratory illness in Adelaide children: breast feeding modifies the effect of passive smoking.** *J Epidemiol Community Health* 44(3):224-30.

STUDY OBJECTIVE—The aim was to investigate the relation between passive smoking and childhood acute respiratory illness. DESIGN—The study involved an initial postal survey on a random sample of children followed by a casecontrol study based on the survey. A respiratory illness score was calculated from maternal reports of episodes of illness in the previous 12 months. SETTING—The study was a population survey based on Adelaide metropolitan area in South Australia. PARTICIPANTS—The reference population (n = 13,996) was all live born children registered in South Australia in 1983 whose parents lived in Adelaide metropolitan area. Of these, 4985 families were contacted by post and from 2125 respondents, 1218 (58%) gave consent for home interview. “Cases” were children with respiratory illness scores in the top 20%, controlling for age and time of year (n = 258); “controls” were taken in the bottom 20% (n = 23 1). MEASUREMENTS AND MAIN RESULTS—Maternal smoking in the first year of life was associated with a doubling in relative odds of respiratory proneness in the child (odds ratio = 2.06, 95% CI 1.25-3.39) after adjustment for confounding by parental history of respiratory illness, other smokers in the home, use of group child care, parent’s occupation, and levels of maternal stress and social support. There was no evidence that this association was attributable to differences in the way smoking and nonsmoking parents perceived or managed childhood acute respiratory illness. Maternal smoking in the first year, without smoking in pregnancy, was also associated with increased risk of respiratory proneness (odds ratio 1.75, 95% CI 1.03-3.0), showing an effect of passive smoking independent of any in utero effect. There was a strong negative effect modification by breast feeding: relative odds of respiratory proneness with maternal smoking were seven times higher among children who were never breast fed than among those who were breast fed. CONCLUSIONS—The results suggest a relatively small but real effect of passive smoking on childhood acute respiratory illness. Effect modification by breast feeding may be due to a combination of behavioural and biological mechanisms.

Woolcock, A.J., & Blackburn, C.R. (1967). **Chronic lung disease in the territory of Papula and New Guinea—an epidemiological study.** *Australas Ann Med* 16(1):11-9.

Xu, X., Dockery, D.W., Christiani, D.C., Li, B., & Huang, H. (1995). **Association of air pollution with hospital outpatient visits in Beijing.** *Arch Environ Health* 50(3):214-20.

Data collected at a community-based hospital in Beijing, China, were analyzed in an assessment of the association of air pollution with daily outpatient visits. Total suspended particle (TSP) measurements were available for 210 d (mean, 388 micrograms/m3; maximum, 1,255 micrograms/m3), and sulfur dioxide (S02) measurements were available for 2 d (mean, 119 n-dcrograms/m3; maximum, 478 rnicrograms/m3). The average number of daily hospital outpatient visits was 1,386; approximately 8.5% of these visits were to the surgery department, 7.9% were to the pediatrics department, and 20.6% were to the internal medicine department A large increase in nonsurgery outpatient visits was observed in association with increases in both S02 and TSP in linear regression models, after adjusting for temperature, humidity, season, and day of the week. The estimated effects (in which the most polluted days were compared with the least polluted days) on nonsurgery outpatient visits were increases of 20% (SE = 5%) and 17% (SE = 4%) in association with increases in S02 and T'SP, respectively. In a department-specific analysis, the association was found to be 1.5- to 2.0-fold stronger for pediatrics and internal medicine visits than for other types of visits. The separate associations of S02 and TSP with internal medicine visits remained statistically significant when both S02 and TSP were considered simultaneously and when adjustment was made for surgery visits. S02 and TSP were found to be significant, independent predictors of internal medicine visits in both winter and summer.

Xu, X., Ding, H., & Wang, X. (1995). **Acute effects of total suspended particles and sulfur dioxides on preterm delivery: a community-based cohort study.** *Arch Environ Health* 50(6):407-15.

The acute effects of air pollution on preterm delivery were examined in a prospective cohort in Beijing, China. From early pregnancy until delivery in 1998, we followed all registered pregnant women who lived in four residential areas of Beijing. Information for both mothers and infants was collected. Daily air pollution and meteorological data were obtained independently. The sample for analysis included 25,370 resident women who gave first live births in 1988. Multiple linear regression and logistic regression were used to estimate the effects of air pollution on gestational age and preterm delivery (i.e., < 37 wk), with adjustment for outdoor temperature and humidity, day of the week, season, maternal age, gender of child, and residential area. Very high concentrations of ambient sulfur dioxide (mean = 102 micrograms/m3, maximum = 630 niicrograms/m3) and total suspended particulates (mean = 375 micrograms/m3, maximum = 10003 micrograms/m3) were observed in these areas. There was a significant dose-dependent association between gestational age and sulfur dioxide and total suspended particulate concentrations. The estimated reduced duration of gestation was .075 wk (1 2.6h) and .042 wk (7.1 h) for each 100-micrograms/m3 increase in sulfur dioxide and total suspended particulates 7-d lagged moving average, respectively. The adjusted odds ratio for preterm delivery was 1.21 (95% Cl = 1.01-1.46) for each in n-dcrograms1m3 increase in sulfur dioxide, and was 1. 10 (95% CI = 1.0 1 - 1.20) for each I 00-micrograms/m3 increase in total suspended particulates. In addition, the gestational age distribution of high-pollution days was more skewed toward the left tail (i.e., very preterm and preterm), compared with low-pollution days. We concluded that high levels of total suspended particulates and sulfur dioxide, or of a more complex pollution mixture associated with these pollutants, appear to contribute to excess risk of preterin delivery in this population. Further work need to be carried out, with more detailed information on personal exposure and effect modifiers.

Zwi, S., Davies, J.C., Becklake, M.R., Goldman, H.I., Reinach, S.G., & Kallenbach, J.M. (1990). **Respiratory health status of children in the eastern Transvaal highveld.** *S Afir Med J* 78(11):647-53.

A study was undertaken to determine if there were detectable effects on the respiratory health status of children resident in the eastern Transvaal highveld as a consequence of their exposure to community air pollution, comparing them with children in areas ostensibly less polluted. A prevalence study was conducted in white schoolchildren from I I schools in the eastern Transvaal highveld (1,031 children) and from 11

schools in non-polluted towns in the Transvaal (978 children). A questionnaire was completed by each child's mother, and height and weight were measured and spirometry recorded on a vitalograph. Cough, wheeze, asthma and chest illnesses were mre frequently reported from polluted areas compared with non-polhited areas, taking into account parental smoking and home cooking fuel (odds ratios 1.34, 1.20, 1.15 and 1.88, respectively). After correcting for age, children in the polluted area were 0.83 cin shorter (P = 0.035). However, there were no significant differences in forced vital capacity and forced expiratory volume in I second after standardising for height, age, parental smoking and home cooking fuel. We conclude that, in children, exposure to pollution in the eastern Transvaal highveld may cause respiratory symptoms and chest illness and may affect height but does not measurably affect lung function, as assessed by spirometry.