

COPD and environmental risk factors other than smoking

10. Socio-economic status (and related factors)

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1. Papers identified

The procedures described in “COPD and risk factors other than smoking. 1. Identifying Relevant Papers” were carried out to identify papers (and reviews) that were relevant to socio-economic status (SES) or related factors, except that, as there were already an adequate number of publications to provide a reliable impression of the evidence, the “secondary references” stage was not attempted. In the MEDLINE searches papers relating “COPD” (or “chronic bronchitis” or “emphysema”) to any of the terms “socioeconomic status”, “education” or “income” were sought.

2. Views from reviews

A number of general review papers of COPD refer to SES as a risk factor for COPD. Some of these merely mention the association without any real discussion¹⁻⁵, though some papers discuss the evidence a little⁶⁻⁸. Some of these reviews allude to the problem of what SES really measures. As Buist and Vollmer⁶ point out, SES “is traditionally determined by the occupation and education of the head of the household and, in countries such as Great Britain, the occupation of the head of the household often defines where a family lives within a city and under what sort of living conditions. A lower socioeconomic status would be associated with living in areas of a city with higher levels of air pollution and in more crowded, colder, and damper houses. Occupational exposure to potential respiratory insults is likely to be considerably higher in blue collar workers than in white collar workers. The rate of respiratory infections is, likewise, likely to be higher.” Buist and Vollmer go on to point out that “As living conditions have improved and environmental and occupational air pollution has diminished in industrialized nations, it is likely that it will be increasingly difficult to demonstrate socioeconomic status as a risk factor for COPD” and that “This may not hold

for developing countries, however, in which there may still be a marked social gradient and, therefore, a gradient in exposure to air pollutants and quality-of-living conditions”. Surprisingly Buist and Vollmer⁶ do not mention smoking in their discussion. Smoking clearly strongly increases risk of COPD and, in many populations and at many times, smoking is considerably more common in the lower social classes. (In the UK smoking was once similarly common in all social classes but now it is much more common in the lower social classes.)

Perhaps because SES can really only be a surrogate for other true causes of disease, review papers limited specifically to the relationship between SES and COPD are thin on the ground. Indeed, I only identified one, by Prescott and Vestbo⁹, and that is only quite brief. They cite 11 studies of adults of SES and COPD that include measures of lung function and, based on this, and other evidence, conclude that:

“The socioeconomic gradient in COPD is as great, if not greater, than in any other disease. The impact of socioeconomic status on symptoms, lung function, and other indices of COPD morbidity and mortality is second only to smoking. The association is important because it represents risk factors that are at least partly modifiable. With increasing socioeconomic differences it is becoming increasingly important to treat socioeconomic status in COPD not just as a ‘nuisance’ parameter to adjust for, but as an independent risk factor whose constituents need to be disentangled.”

3. Specific studies

Table 1 summarizes evidence from 52 publications identified from the searches¹⁰⁻⁶¹. Of the studies, 43 present the results of analyses adjusted at least minimally for smoking (and usually other variables). Of these 43 studies, 35 report significant associations of increased COPD (or reduced lung function) in those with lower social class, reduced income, less education, etc. Although there doubtless remains some residual confounding (particularly in studies which carry out relatively simple adjustments for smoking), it still

appears likely to be true that the higher COPD risk in the lower social classes cannot be fully explained by smoking.

Of the studies cited in Table 1 most only treat SES, education, income etc. as one of a number of risk factors considered in analysis. However, there are a number of publications for which this relationship appears to be the central interest^{10,24,26,30,38,41,45-48,52}. Conclusions from some of these publications are of interest:

Steenland et al (2002)⁵² described detailed analyses relating education to mortality from various causes, based on data from the well-known American Cancer Society CPS I and CPS II studies. They noted that “The inverse relation between education and mortality was strongest for coronary heart disease, lung cancer, diabetes and chronic obstructive pulmonary disease ...” and that “Adjustment for conventional risk factors, probable intermediate variables between education and mortality, diminished but did not eliminate the observed educational/mortality gradients”.

Bakke et al (1995)¹⁰ based on a study in Norway, concluded that “The survey indicates that educational level is a risk factor for airway disorders independent of smoking and occupational airborne exposure”.

Ellison-Loschmann et al (2007)²⁴, based on the European Community Respiratory Health Survey (ECRHS) conducted in 13 European countries, USA, Australia and New Zealand, noted an association of chronic bronchitis with low educational and low social class, pointing out that “adjusting for potential explanatory variables related to socioeconomic status did not modify much of the association, suggesting that other factors in adult life or in childhood may mediate the occurrence of socioeconomic differences in respiratory disease”.

From an early study in Tecumseh, USA, Higgins et al (1977)²⁶ noted that “Most of the differences in the prevalence of chronic bronchitis and

mean 1-sec forced expiratory volume in men and women in different occupational, educational, or income classes were due to differences in smoking habits. In comparison with smoking, poor occupational, educational, or economic circumstances had only a weak deleterious effect”.

Although the main interest of this document concerns indices of the SES of the subject as an adult, it should be noted that analyses by Prescott et al (1999)⁴⁵, based on the Copenhagen City Heart Study, conclude that “The results indicate that socioeconomic factors operating from early in life affect the adult risk of developing chronic obstructive pulmonary disease independently of smoking in both females and males”.

A further paper based on the same study⁴⁶ concluded that “The results confirm the existence of a strong social gradient in respiratory mortality and chronic obstructive pulmonary disease, which is independent of smoking and is stronger in males. Social disadvantage is a potentially avoidable cause of death from respiratory disease and further research is needed to explain the excess risk in the socioeconomically disadvantaged”.

4. Conclusions

The evidence reviewed strongly indicates that there is an association of low social class (reduced income, less education) with COPD that cannot be explained by confounding by smoking. The extent to which the association is due to occupation, air pollution, or other factors, is, however, unclear.

5. References

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TABLE 1 Summary of studies of COPD and SES related factors

<u>Source</u>	<u>Location</u>	<u>Study design^a</u>	<u>SES index^b</u>	<u>Endpoint^c</u>	<u>Result^d</u>	<u>Adjusted for smoking</u>
Bakke et al (1995) ¹⁰	Norway	C	Educational level	OLD	+	Yes
Bang et al (1990) ¹¹	USA	C	Poverty level	CB	NS	Yes
Britten et al (1987) ¹²	UK	P	Home ownership	Lung function	+	Yes
Brown et al (1957) ¹³	UK	C	Social class	CB	+(S)	Yes
Burchfiel et al (1996) ¹⁴	USA	P	Education	FEV ₁ decline	+(N)	Yes
Cerveri et al (2001) ¹⁵	16 countries ^e	C	SES	CB	+(M)	Yes
Chan-Yeung et al (2007) ¹⁶	Hong Kong	CC	Education	COPD	+	Yes
Chen et al (2000) ¹⁷	Canada	C	Income	COPD	+	Yes
Cohen et al (1977) ¹⁸	USA	CC	SES	COPD	+	Yes
College of General Practitioners (1961) ¹⁹	UK	C	Social class	CB	+	Yes
Dean et al (1977) ²⁰	UK	CC	Social class	CB	+	Yes
Dean et al (1978) ²¹	UK	C	Social class	CB	+	Yes
De Marco et al (2004) ²²	16 countries ^e	C	SES	COPD	+	Yes
Ehrlich et al (2004) ²³	S Africa	C	Education	CB	+	Yes
Ellison-Loschmann et al (2007) ²⁴	16 countries ^e	C	SES, education	CB	+	Yes
Enright et al (1994) ²⁵	USA	C	Income, education	AO, CB, EMP	+(income, AO), -(education, CB)	Yes
Higgins et al (1977) ²⁶	USA	C	Income, education	CB, lung function	+	Yes
Hrubec et al (1973) ²⁷	USA	C	SES	CB	+	Yes
Huchon et al (2002) ²⁸	France	C	SES	CB	NS	No
Huhti et al (1978) ²⁹	Finland	C	Social group	CNSLD	NS	Yes
Huisman et al (2005) ³⁰	W Europe	P	Education	COPD	+	No
Jindal et al (2006) ³¹	India	C	SES	CB	+	Yes

TABLE 1 Summary of studies of COPD and SES related factors
(continued)

<u>Source</u>	<u>Location</u>	<u>Study design^a</u>	<u>SES index^b</u>	<u>Endpoint^c</u>	<u>Result^d</u>	<u>Adjusted for smoking</u>
Johannessen et al (2005) ³²	Norway	C	Education	COPD	+	Yes
Jousilahti et al (2000) ³³	Finland	P	SES	COPD	+	Yes
Kim et al (2005) ³⁴	Korea	C	Income	COPD	+	Yes
Krzyzanowski et al (1986) ³⁵	Poland	P	Education	COPD, FEV ₁ decline	NS	Yes
Lange et al (1989) ³⁶	Denmark	C	Income, education	FEV ₁	+	Yes
Lange et al (2003) ³⁷	Denmark	C	Education	CB	NS	Yes
Lebowitz et al (1977) ³⁸	USA	C	Income, education ^f	CB, OLD	+	Yes
Menezes et al (1994) ³⁹	Brazil	C	Income, schooling	CB	+	Yes
Meyer et al (2002) ⁴⁰	USA	CC(D)	Income, education	COPD	No	No
Naess et al (2005) ⁴¹	Norway	P	Social class, income, education, housing	COPD	+	No
Nejjari et al (1996) ⁴²	France	C	Social class, education	CB	+(social class)	Yes
Nihlén et al (2004) ⁴³	Sweden	P	Social class	COPD	NS	No
Ogilvie and Newell (1957) ⁴⁴	UK	C	Social class	CB	+	No
Prescott et al (1999) ⁴⁵	Denmark	P	SES	COPD, FEV ₁	+	Yes
Prescott et al (2003) ⁴⁶	Denmark	P	Education ^e	COPD	+	Yes
Regidor et al (2003) ⁴⁷	Spain	P	Education	COPD	+	No
Rimington (1969) ⁴⁸	UK	C	Social class	CB	NS (?)	Yes
Schwartz and Weiss (1990) ⁴⁹	USA	C	Income, education	CB	+	Yes
Shin et al (2003) ⁵⁰	Korea	C	Income, education	AO	NS	No

TABLE 1 Summary of studies of COPD and SES related factors
(continued/2)

<u>Source</u>	<u>Location</u>	<u>Study design^a</u>	<u>SES index^b</u>	<u>Endpoint^c</u>	<u>Result^d</u>	<u>Adjusted for smoking</u>
Stebbing (1971) ⁵¹	USA	C	Social class, income, education	FEV ₁	+ (N)	Yes
Steenland et al (2002) ⁵²	USA	2P ^h	Education	COPD	+	Yes
Suadicani et al (2001) ⁵³	Denmark	C	Social class	CB	NS	Yes
Tabak and Smit (2001) ⁵⁴	Netherlands	C	Education	COPD	+	Yes
Trupin et al (2003) ⁵⁵	USA	C	Income, education	COPD	+	No
Turkeltaub and Gergen (1991) ⁵⁶	USA	C	Poverty index	CB	NS	Yes
Tzonou et al (1992) ⁵⁷	Greece	CC	Schooling	COPD	+	Yes
Van Rossum et al (2000) ⁵⁸	UK	P	Social class	CB	+	Yes
Viegi et al (2000) ⁵⁹	Italy	C	SES	COPD	NS	Yes
Yamaguchi et al (1988) ⁶⁰	Japan and China	C	SES	CB, AO	+	Yes
Zhong et al (2007) ⁶¹	China	C	Education	COPD	+	Yes

^a Abbreviations used for study design: C = cross-sectional, CC = case-control, CC(D) = case-control study of decedents, P = prospective studies. Some of the analyses of data from prospective studies were cross-sectional

^b The term social class was used to refer to grades based on occupation, and is referred to by other terms, such as employment grade, in some of the source papers; SES = socio-economic status

^c Abbreviations used for endpoint: AO = airways obstruction, CB = chronic bronchitis, CNSLD = chronic non-specific lung disease, COPD = chronic obstructive pulmonary disease, EMP = emphysema, FEV₁ = forced expiratory volume in one second, OLD = obstructive lung disease

^d + indicates that a significant increase in disease or decrease in lung function was seen in relation to low education, low income, lower social class, low SES, increasing schooling, increased poverty or worse housing conditions. - indicates a significant difference in the opposite direction. NS = no significant association. +(S) indicates a significant effect only in smokers, +(N) only in nonsmokers, +(M) only in males

^e 13 in Europe (Belgium, Denmark, France, Germany, Iceland, Ireland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland and UK) plus USA, Australia and New Zealand

^f Social mobility, residential mobility, crowding, and other housing factors were also studied and found to have inconsistent and usually non-significant associations with lung problems

^g Less detailed analyses relating total respiratory disease to employment grade, income and housing were also presented. These were generally significant for males, but not for females