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PERSPECTIVE

Air pollution and pregnancy: A long history of rising exposure

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Humans have been exposed to air pollution for millennia, from both natural (volcanoes and wildfires) and man-made (heating, lighting, cooking and manufacturing) sources. By the Middle Ages air pollution was already recognised as a health problem in England. Burning coal rather than wood was prohibited in London in 1273, having been declared 'prejudicial to health', and King Edward I of England supported this ban with a royal proclamation in 1306 (www.

CO Content and HbCO Saturation of Foetal and Maternal Blood

Mother			Foetus			Foetal/Maternal	
HbO_2 Capacity (vols. %)	Blood CO (vols. %)	HbCO (% saturation)	HbO_2 Capacity (vols. %)	Blood CO (vols. %)	HbCO (% saturation)	Blood CO (vols. %)	HbCO (% saturation)
			Non-smokers				
19·6	0·34	1·71	26·8	0·37	1·37	1·09	0·801
18·5	0·32	1·67	22·0	0·41	1·81	1·28	1·084
—	0·26	—	—	0·32	—	—	—
17·0	0·36	2·07	18·2	0·32	1·73	0·89	0·836
14·1	0·21	1·47	24·6	0·47	1·87	2·24	1·272
17·3	0·39	2·20	19·2	0·42	2·14	1·08	0·973
17·8	0·23	1·27	23·1	0·23	0·97	1·00	0·764
18·6	0·24	1·28	23·7	0·35	1·44	1·38	1·125
16·3	0·14	0·82	20·4	0·26	1·24	1·86	1·512
17·6	0·29	1·62	24·0	0·46	1·88	1·59	1·160
Mean 17·4	0·28	1·57	22·4	0·36	1·61	1·38	1·06
S.D. ±1·6	±0·08	±0·42	±2·77	±0·08	±0·37	±0·45	±0·24
			Smokers				
17·4	0·22	1·25	22·8	0·38	1·64	1·73	1·312
20·1	0·21	1·03	20·7	0·30	1·43	1·43	1·388
15·5	0·29	1·84	21·2	0·54	2·49	1·86	1·353
15·4	0·36	2·29	21·8	0·54	2·42	1·50	1·057
17·2	0·54	3·05	21·7	0·62	2·78	1·15	0·911
15·0	0·39	2·53	21·4	0·76	3·44	1·95	1·360
Mean 16·7	0·33	2·00	21·6	0·52	2·37	1·60	1·23
S.D. ±1·9	±0·12	±0·77	±0·70	±0·17	±0·74	±0·30	±0·20

FIGURE 1 Carbon monoxide (CO) content and carboxyhaemoglobin (HbCO) saturation of fetal and maternal blood.

air-quality.org.uk). However, this measure was difficult to implement. Severe pollution episodes or 'smogs' (resulting from the combination of smoke, fog and sulphur dioxide (SO_2) emissions) were recorded from as early as the 17th century. The energy to power the industrial revolution required a vast consumption of fossil fuel. The resulting smoke from factories and railways rapidly became the dominant source of air pollution in the towns of the UK. Smogs or 'pea-soupers' were a regular feature of life in Victorian London, and recurred throughout the 20th century.

From the late 19th century, spreading industrialisation has accelerated the emission of air pollutants worldwide. An additional related risk, first recognised by Canadian physicist Gilbert Plass in the1950s, and now well established, was the link between the increased use of fossil fuels and the rising levels of carbon dioxide (CO_2) in the atmosphere, leading to 'global warming' (Plass, *Scientific American* 1959;201:41–7).

Much of the epidemiological, clinical and basic science research into the effects of air pollution on human health has focused on the development of respiratory diseases, particularly asthma (Bharadwaj et al., *Am J Respir Crit Care Med* 2016;194:1475–82). However, in recent decades, there has been a growing awareness of the association between maternal exposure to air pollution during pregnancy and the risks of preterm birth, placental abruption and stillbirth. In a small study comparing carbon monoxide (CO) levels in maternal and fetal blood between groups of smokers and non-smokers, Young and Pugh found no significant difference. They concluded that maternal exposure to CO during pregnancy is not the main factor in the association between smoking and low birthweight. They also found that CO levels were higher in both groups than in non-smoking male laboratory workers, indicating potential environmental exposure to CO from sources other than smoking (Young & Pugh, *J Obstet Gynaecol Br Commonw* 1963;70:681–4) (Figure 1).

The challenge of establishing the individual contribution of exposure to a particular environmental factor is illustrated in an article by Baird (*Br J Obstet Gynaecol* 1980;87:1057–84). He describes the many confounding socio-economic factors that have specific effects on pregnancy outcome, such as unemployment, poverty and health during childhood, and that are impossible to separate. Following implementation of version 2 of the Saving Babies Lives Care Bundle (SBLCBv2) and to comply with the recommendations of the Maternity Incentive Scheme, all UK National Health Service (NHS) trusts are now required to assess maternal CO levels throughout pregnancy. The identification of high CO levels may perhaps motivate pregnant women to quit smoking, service their gas appliances and instal CO alarms at home, but tackling the wider causes of air pollution will require more concerted action from all of us and from our governments.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

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