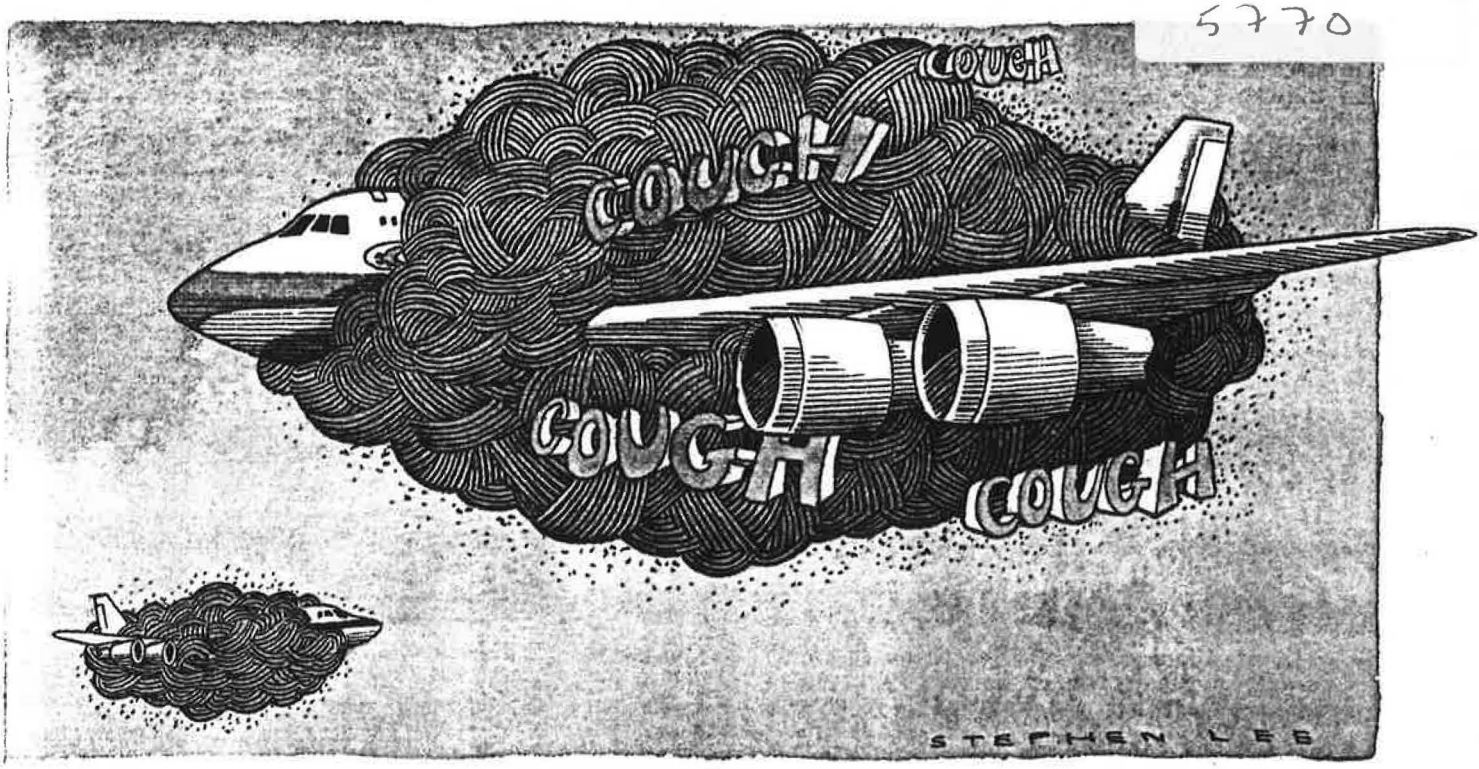


Every breath you take

Poor in-flight ventilation is being blamed increasingly for passengers' ailments. *Caroline Fossey* investigates how flying can be hazardous to your health.

Is flying hazardous to your health? Aside from the effects of jetlag and stress from delayed flights, another little-mentioned hazard of flying has emerged – the quality of air on board.

Passengers are increasingly complaining of headaches and sore eyes after flying and blame the quality of air in the cabin. Tobacco smoke is the most obvious culprit, largely because it is visible and has received so much negative publicity. But Dr Larry Holcomb, a consultant in environmental toxicology advising the US government, claims that cigarette smoke is only one of many in-flight pollutants; the odour of smoke is no more harmful than the reek of strong perfume too vigorously applied or the after-effects of overindulging in garlic the night before. There is ample scientific evidence to support this conclusion – see box – so too that poor ventilation rather than tobacco smoke should be blamed for the ill effects sometimes felt by travellers.

Cabin air is changed around 18–25 times an hour. It is a mix of recycled air which has been filtered and air which is brought in from outside. External air is fed through compressors in the engines to raise its temperature to a bearable level. At 20,000 feet, outside air is −30°C (−22°F); at 30,000 feet, it is −47°C (−58°F).

The air then passes through fixed outlets in the ceiling or sidewalls below the storage bins and flows through the cabin down to floor level grilles along both sides of the cabin from which it exits. It then either goes back to be recycled or descends to the cargo hold.

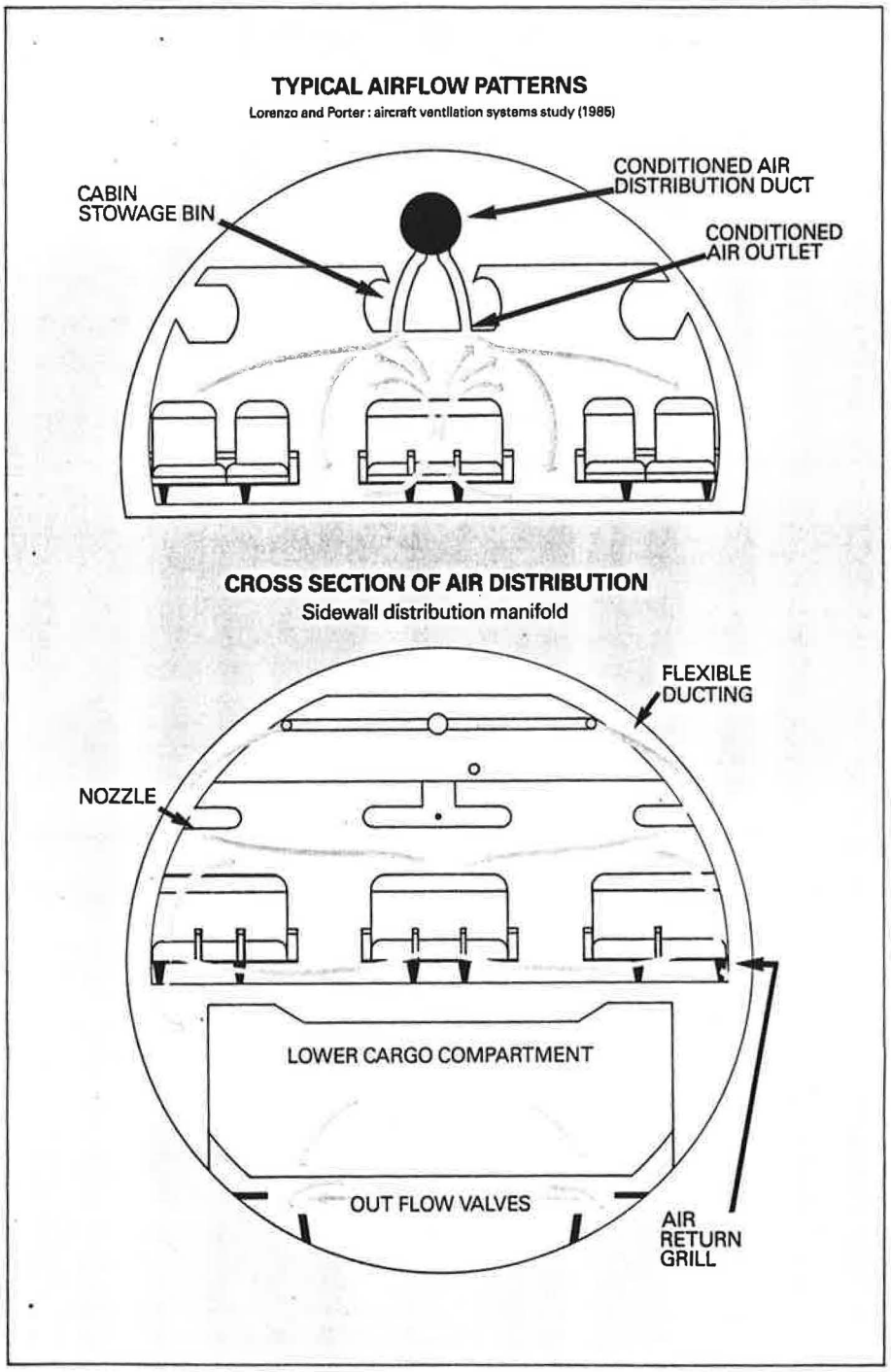
Not surprisingly, passengers at the front of the plane breathe more easily. Air is not distributed on a per passenger basis so the smaller cabins of First and Business class have two or three times more ventilation than those packed in the back, in Economy class. The number of passengers is vital when calculating the ventilation rate but modern ventilation systems do not have much flexibility. Obviously the fewer passengers on board, the better the air will be. The cockpit has its own supply of air ▷

which is ten times more than that supplied to the passenger cabins. This is law set out by the FAA and ensures the flight equipment is kept cool.

There is some mixing of air between the various sections (see table, which breaks down components found in cabin air) due to the slight backward flow of air in the cabin.

Cabin temperatures are set out by the crews at between 18°C (65°F) and 27°C (85°F). The crews can also reduce the ventilation rate to half or two-thirds that specified by the manufacturers. It is estimated that if the rate is halved, 1% of an airline's annual fuel bill can be saved.

Airline economics also dictate the amount of external air on board. Modern aircraft use a mixture of recycled and external air. Obviously the more external air used, the fresher and less polluted it is, but using outside air only takes more out of the engine and therefore requires more fuel. Energy would be diverted from propelling the plane forward to filtering and warming the air for passenger use.



Onboard air is cleanest when the plane is cruising and at its most polluted when waiting for take-off. Airports are notorious souces of pollution. Lufthansa tested the cabin air of one of its flights 30 minutes after take-off and discovered traces of kerosene fumes still present in the air. Aircraft engines give out many potentially toxic substances, and when they are idling, they are at their most inefficient. A test carried out several years ago at Los Angeles airport found levels of pollutants inside the cabin equal to those outside. Passengers waiting on board for longer than 30 minutes when the ventilation systems are not working should return to the terminal. Open doors are not adequate and using unfiltered, untreated, recirculated air can be dangerous and cause infections to be spread by people being cooped up too close together.

Apart from tobacco smoke and diseases spread by fellow passengers through inadequate ventilation, other nasties lurk in the aircraft cabin to make flying hazardous to your health.

There's the low relative humidity which means the air is dry and causes burning eyes (especially irritating for those wearing contact lenses), and dry noses and throats. The level of water vapour in the atmosphere is between 70–80% but most people are comfortable with a 30–60% level. However, on commercial flights monitored by the FAA, it discovered levels of between 10 and 20%, while others showed variations from 2–23%. Flights of three to four hours in the 5–10% humidity range cause discomfort.

Low humidity is caused by outside air which, although clean, is dry as moisture is removed when the engine compressors treat the cold air. Airborne viruses flourish in low humidity so planes can become highly infectious places if the ventilation system is inefficient. Bacteria and fungal spores are also carried by air and may lodge in seat fabric, staying active for days.

Humidity can't be controlled and passengers are dependent on steam produced by food preparation in the galleys and water from the breath and perspiration of fellow passengers. So, although the air might be fresher with fewer people on board, it will also be drier.

Breathing, however, causes another pollutant – carbon dioxide (CO^2). If there is poor ventilation, there is a build-up of CO^2 which makes the cabin stuffy and causes headaches and lethargy.

Concorde passengers are particularly prone flying twice the speed of sound exposes you to ozone (O^3), which is present in the upper atmosphere where the aircraft cruise. Aircraft emissions are far more potent 30,000 feet up

than they are on the ground. Although they only contribute about 3% to the total of man-made emissions, their effect is 30 times greater than that of surface emissions. The amount of O^3 varies depending on the season (most common in spring), weather and cruising altitude. Catalytic converters remove as much as is possible but are only 90–95% efficient. Exposure to O^3 causes coughing, throat, nose and lung irritation with possible difficulties in breathing. Of all flights monitored by the FAA, 11% contained more O^3 than FAA regulations allow.

If the thought of your next business trip sends you rushing to buy a mask and oxygen tank, don't be too hasty. According to the Swedish report, aircraft cabin air does not have higher levels of contaminants than many other indoor locations. "Any possible long-term health effects are most likely insignificant in passengers and cabin crew with or without compromising medical conditions."

The Swedes do add, though, that if airline cabin air quality were judged according to comfort and well-being, it is doubtful it would satisfy anybody's demands.

According to medical specialists in both the UK and the USA, 10% of the average passenger load is not totally fit. Dr F S Khan, in his book *The Curse of Icarus*, points out that flying is unlike any other form of transport and places unnatural strains on the body.

What to do to minimise discomfort during your flight? We asked the airlines to point the way. They suggest:

☐ wear loose, comfortable clothes

☐ don't eat just for the sake of eating

☐ avoid heavy meals, as too much food cannot be digested easily when the body is inactive

☐ drink plenty of liquid but avoid alcohol (a drink in the air is twice as potent as one on the ground), tea and coffee, which act as diuretics

☐ take every opportunity to move around and keep your circulation going

☐ rub some moisturising cream round your nostrils to prevent dryness

☐ contact lens wearers should opt for glasses – if this is impossible, use eyedrops to counteract the dry atmosphere.

A couple of the airlines suggest trying to prepare for your destination with its different time zone in advance by adjusting meal and rest times.

Japan Airlines is very much to the fore in encouraging passengers to look after themselves when flying. The airline has published *JAL Handy*, an 82-page booklet giving not only flight and destination information, but also advice on how to "enjoy your flight". Passengers should move around every 20 minutes. If you don't want to keep disturbing your long-suffering neighbour who is trying to sleep, try some of the 14 exercises outlined in the book which can be carried out in your seat. These range from feet-os (feet rotations) to finger isometrics to in-flight skiing for the more energetic traveller, possibly sitting alone.

To counteract the dryness in the cabin, JAL adds a "humidity preserving" honeycomb mask to the Business class amenities kit. This mask, especially designed for air travel, absorbs humidity in the air we exhale and provides adequate humidity to the air we breathe in to alleviate the dry atmosphere.

SAS flights, too, carry brochures in the seat pockets with advice from the airline's medical department. The brochure tells you how to minimise jetlag and improve blood circulation. A page of sketches showing how to exercise various parts of the body is also attached. **BT**

In his paper, *Aeroplane smoking: plain facts about a confused issue*, published last July, Dr Holcomb says that there is no scientific evidence to suggest that smoking should be singled out and banned on commercial aircraft.

He is not alone in his findings. Dr John Dilley, consultant occupational physician in the UK, points out that there is considerable controversy as to the adverse effects – if indeed there are any – of tobacco smoke on health: "To date, I have been unable to identify any from scientific evidence in the average adult."

There is no doubt, however, that some non-smokers find it upsetting to sit in a smoky atmosphere, breathing in someone else's fumes. Planes are unique in that people bothered by their neighbours' habits cannot easily escape. According to Air Canada, which has banned smoking on all its transatlantic flights since October 1990, 12% of its passengers say that the airline's non-smoking policy greatly influenced their choice of airline.

What about flight crews who fly an average 70–80 hours a month? A study carried out by researchers Follart, Benowitz and Becker on six non-smoking SAS flight attendants showed that the content of nicotine in the blood of five of the attendants had doubled. However, this is at most one-fifth of the nicotine level found in regular smokers.

According to Dr Holcomb, "ETS (Environmental Tobacco Smoke) exposure is limited to the times passenger smoking is permitted. Because of limited and intermittent exposure, a health effect involving ETS would not be experienced." Also, non-smokers do not breathe in smoke as deeply as smokers do.

A Swedish report on air quality in DC9 and MD80 planes, published in June 1989, concluded: "long-term health effects normally need long-term exposure. Passenger flying time is less than one-thousandth of their lives. Intermittent exposures with intervals for recovery favourably counteract most long-term health effects."

There is the fear that passive smoking causes lung cancer. Although tobacco smoke does contain toxins, researchers did not notice the number of people developing lung cancer increasing at the same rate as people taking up smoking during the period 1910–1970 when smoking was becoming popular.

Before smokers were segregated, aircraft were able to cope with smoke, which was spread fairly evenly throughout the plane. When segregation was introduced, however, it was often difficult for the old ventilation systems to cope with dense concentrations of tobacco smoke in certain parts of the cabin.

Modern planes, with their more advanced ventilation systems, are better able to deal with the smoke. Filters remove lint, aerosols and gaseous tars from cigarette smoke and some B757s and B767s have charcoal filters which can remove gas and smells as well. Filters can become ineffective, however, if not cleaned regularly.

Average levels of components found in tobacco smoke measured in microgrammes per cubic metre

	Business non-smoking	Business smoking	Economy non-smoking	Economy smoking
RSP*	60	250	160	220
Nicotine	5	41	21	32
CO^1	0.6	1.1	0.8	1.1
CO^2	1,300	1,300	1,300	1,300
Humidity	25%	25%	25%	25%

* RSP = Respirable suspended particles

Taken from a University of Stockholm report on air quality in DC9 and MD80 aircraft, published June 1989.