Lung function and smoking see for yourself!

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"Anti-smoking" initiatives have tended to rely heavily on effects of smoking that come to prominence in adulthood. The writer has developed a means of testing the respiratory function of pupils. The effect of smoking upon this function can immediately be seen; "most smokers appear to be concerned that their results are poorer than those of their non-smoking peers, and say that they feel they ought to try to give up."

Respiratory diseases are an important cause of illness and loss of working time amongst adults, and also contribute significantly to absence from school. There is, therefore, a need to improve methods of teaching respiratory function in schools, and to provide realistic techniques for anti-smoking health education. It is largely irrelevant to tell 11- or 12-year-olds that they are likely to die of lung cancer or heart disease when they are 40 if they continue to smoke, or take up smoking, as the 'goal' is so far distant. If, on the other hand, it is possible to demonstrate in the classroom that smokers have *already* damaged themselves, and are at a disadvantage compared with their non-smoking peers as far as lung function is concerned, then it has been shown that they are more likely to give up smoking.

Smoking causes inflammation of the lining membrane of the respiratory passages. The resulting narrowing of the bore slows down the flow of air. Thus, in smokers we find lower flow rates. Measurement of the two flow rates 3 and 4 below, which respectively represent the flow of air through the larger passages and through the smaller bronchi and bronchioles, shows that in this series the smokers have lower flow rates.

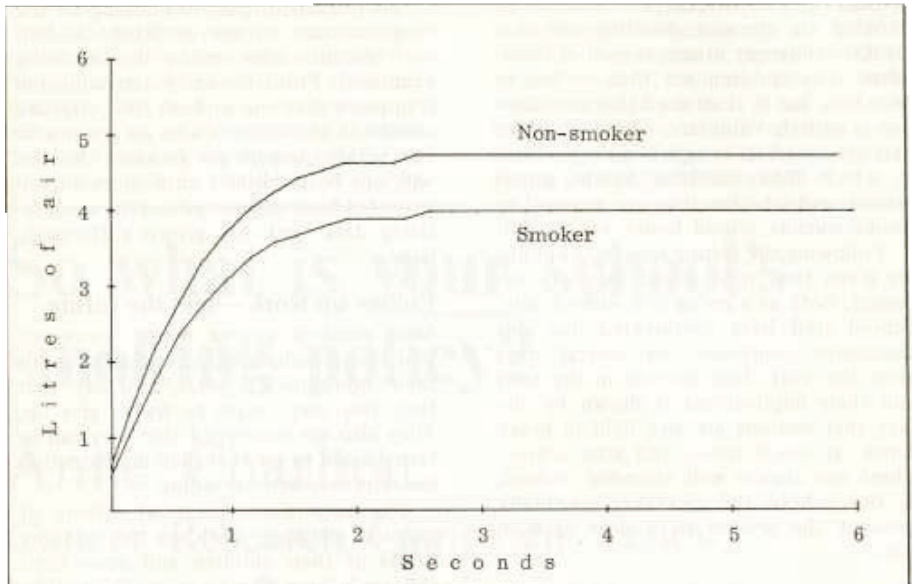
Testing the lung function

Lung function tests are simple to apply, are reliable, and provide an immediate record of the child's respiratory function. The test involves taking a deep breath and then blowing into a recording spirometer. Results obtained from repeated tests on the same individual show a high reliability.

The parameters measured are:

1. *The Forced Vital Capacity.* This is the total amount of air that can be exhaled from full inspiration to full expiration. In itself, this merely shows the total lung capacity, and varies according to the body size of the individual.
2. *The Forced Expiratory Volume after 1 sec.* This is the amount of air exhaled in the first second. It is related to the ability to exhale forcibly.
3. *The Forced Expiratory Flow (0.2 – 1.2 litres).* This flow rate relates to the flow of the first litre of air through the trachea and the larger bronchi. It is improved by such activities as swimming, running, and strength training. Smoking, upper respiratory infections, and asthma cause some impairment.
4. *The Forced Expiratory Flow 25% – 75%.* This is the flow rate measured over the middle half of the exhaled breath. It measures the flow rate when the air is coming from the smaller bronchi and bronchioles. It is improved by regular participation in sport, particularly in sports such as running and cycling where large volumes of air are exchanged. It is seriously impaired by smoking, and by upper respiratory infections and asthma.

Spirograms are also plotted, as these quickly reveal a difference between smokers and non-smokers (see diagram). At present these spirograms are plotted by computer, but in the near future the computer printout will include a set of co-ordinates which will allow the individual to plot his or her own curve, thus involving each child in working out its own results.



Two spirograms obtained by the author. The 'Non-smoker' was aged 15. The 'Smoker' was a 17-year-old who had smoked 5 cigarettes a day over the past 4 years.

	Non-smoker	*Smoker*
Forced Vital Capacity	4.6 litres	3.9 litres
Forced Expiratory Volume after 1 sec.	3.5 litres	3.0 litres
Forced Expiratory Flow (0.2 – 1.2 litres)	449 litres/min.	300 litres/min.
Forced Expiratory Flow (25% – 75%)	243 litres/min.	212 litres/min.

Discussion – test – discussion!

The testing session starts with a discussion of our lungs, why we need to breathe, how the lungs work, what happens when we take exercise, and factors that can impair lung function. Then the effects of inhaling dust, pollen, diesel fumes, and cigarette smoke are discussed. The information is obtained by question and answer, and discussion is encouraged at

all stages. The effects of 'secondary' smoking are stressed, pointing out that smokers endanger others as well as themselves. The children are then invited to do a test, but it is stressed that participation is entirely voluntary. Those who take part are asked to complete a simple form in which their smoking habits, games played, and whether they are exposed to smoke outside school hours, are set out.

Following the testing session the pupils are given their results, and these are discussed, both as a group and individually. School staff have commented that this discussion continues for several days after the visit. This interest in the tests and their implications is shown by the fact that sessions are also held in break times, at lunch times, and after school. These are always well attended; indeed, in one school the caretaker eventually brought the session to a close at 6.30 p.m.!

The smoking environment

To compare smokers and non-smokers does not, in fact, give a true picture. Some non-smokers are affected by smoke from other people: therefore we must also consider the effect on the lung function of children of their parents' smoking habits.

If we analyse the lung function of non-smoking children whose parents do not smoke and compare these results with the figures of children who do smoke, then we will obtain a truer picture of the effects of smoking upon lung function. This comparison reveals that children who smoke do have considerable impairment of their flow rates.

Parental influence on the smoking habits of children is indicated by the fact that in this series we find that:

Girls who are non-smokers –
44% of families smoke.

Girls who are smokers –
76.5% of families smoke.

Boys who are non-smokers –
55% of families smoke.

Boys who are smokers –
76.5% of families smoke.

The effects of passive smoking on the lung function of non-smoking children with parents who smoke is also being examined. From the early data collected it appears that *one or both flow rates are smaller in the children who do not smoke but whose parents are smokers.* Results will not be published until more survey work has been completed and the accumulating data bank has grown sufficiently large.

Follow-up work – and the future

Most smokers appear to be concerned that their results are poorer than those of their non-smoking peers, and say that they feel they ought to try to give up. They also are concerned that they can be tested again to see that their lung function has improved after stopping.

The surprisingly clear-cut effects of parental smoking, both on the smoking habits of their children and upon their children's lung function, make it clear that there is a need to talk to parents about this problem. In future it is hoped to arrange a talk for parents and staff during visits to schools.

At present, the project is being funded entirely by the Rehabilitation and Medical Research Trust. However, further financial help is urgently needed. The present project runs for two years from October 1984, yet a number of schools have asked for a longitudinal study to be carried out in which this year's 1st year is followed through for the whole of their school career. This would provide essential statistics concerning the development of respiratory function in children, and would allow the results of systematic anti-smoking health education to be assessed. At present there is no money for this study.

There is also a need to develop a spirometer which can be used in schools for lung function studies. We have already developed a prototype which is being used in the current research. It is likely that this could be developed, together with the necessary software for use with the BBC microcomputer, at a very economic price. This spirometer could be used