1 Wjst M, Reitmeir M, Dold S, Wulff A, Nicolai T, Freifrau von Loeffelholz-Colberg E, *et al.* Road traffic and adverse effects on respiratory health in children. *BMJ* 1993;307:596-600.
2 Weiland SK, Nundt KA, Rückman A, Keil U. Self-reported wheezing and allergic rhinitis in children and traffic density on street of residence. *Ann Epidemiol* 1994;4:79-83.
3 Edwards J Walters S Griffiths RC. Hospital admissions for asthma in pre-school children: relationship to major roads in Birmingham UK. *Arch Environ Health* 1994;49:223-7.
4 Waldron G, Pottle B, Dod J. Asthma and the motorways—one district's experience. *J Public Health Med* 1995;17:85-9.
5 Diggle PJ, Rowlingson BS. A conditional approach to point process modelling of elevated risk. *Journal of the Royal Statistics Society, Section A* 1994;157: 433-40.

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Commentary: Traffic exposure and asthma: problems of interpretation

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Neither air pollution nor asthma is a new problem, but in the past decade there has been increasing concern that the apparent increase in the prevalence of asthma may be due to increasing exposure to pollution, particularly from motor vehicles.[1]

Vehicles emit many pollutants, but in relation to asthma interest has focused on particulate matter and nitrogen oxides (mainly nitrogen monoxide). Nitrogen monoxide is rapidly oxidised to nitrogen dioxide, which in turn, and at a distance, catalyses the formation of ozone. Proximity to major roads or estimates of local traffic density have been used as indicators of exposure to vehicle exhaust fumes in several recent epidemiological studies, including that by Livingstone and colleagues.[2] The relation of traffic exposure to pollutant exposure, however, is far from straightforward, and this complicates the interpretation of both positive[3,4] and negative[2] findings.

Although mean nitrogen oxide and particulate concentrations decrease with distance from the kerb,[3] the decline beyond 20 m is small. No correlation between traffic density and ambient nitrogen dioxide concentrations was found in Munich,[4] although carbon monoxide, benzene, and toluene (pollutants related to vehicles that are not implicated in asthma) were more concentrated in areas of higher traffic flow. Higher traffic density was inversely correlated with concentrations of ozone,[4] which is formed at some distance from emission sources and scavenged in city centres by nitrogen monoxide from vehicles.

Hitherto, epidemiological studies have imputed traffic exposure from place of residence. Yet, for many people the environment close to home represents only a small part of their daily exposure to outdoor air. Furthermore, indoor sources (particularly cooking fuels and environmental tobacco smoke) are more important influences on personal exposure to both nitrogen oxides and airborne particulates. Only a small increase in personal exposure to these pollutants was discernible for subjects living close to major roads in Tokyo.[5]

When significant associations between recurrent wheezing and traffic exposure have been reported—for example, among Japanese women[3] and German children[4]—the prevalence varies (in relative terms) by up to 50% across the range of traffic exposures. This is a modest difference but arguably too great to be explained by the subtle variations in measured exposures to pollutants related to local traffic density. This does not exclude the possibility that other vehicle related pollutants may have a hitherto unsuspected role in initiating or exacerbating asthma, but it argues for a cautious interpretation and careful consideration of possible confounding factors and reporting artefacts.

On the other hand, the failure of a statistically powerful study such as that by Livingstone and colleagues to show an association between local traffic density and prevalence of disease[2] does not refute the possibility of a more general link between air pollution and asthma because place of residence is such a poor indicator of personal exposure to traffic related pollutants. Nevertheless, these findings do offer reassurance to city dwellers living close to busy roads that the location of their home does not place them or their children at substantially increased risk of asthma.

1 Department of Health Committee on the Medical Effects of Air Pollutants. *Asthma and outdoor air pollution*. London: HMSO, 1995.
2 Livingstone AE, Shaddick G, Grundy C, Elliott P. Do people living near inner city main roads have more asthma needing treatment? Case-control study. *BMJ* 1996;311:676-7.
3 Nitta H, Sato T, Nakai S, Maeda K, Aoko S, Ono M. Respiratory health associated with exposure to automobile exhaust. I. Results of cross-sectional studies in 1979, 1982 and 1983. *Arch Environ Health* 1993;48:53-8.
4 Wjst M, Reitmar P, Dold S, Wulff A, Nicolai T, von Loeffelholz-Colberg EF, *et al.* Road traffic and adverse effects on respiratory health in children. *BMJ* 1993;307:596-600.
5 Ono M, Hirano S, Murakami M, Nitta H, Nakai S, Maeda K. Measurements of particle and NO_2 concentrations in homes along the major arterial roads in Tokyo. *Journal of the Japanese Society of Air Pollution* 1989;24:90-9.

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Effect of fish oil on heart rate variability in survivors of myocardial infarction: a double blind randomised controlled trial

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Marine n-3 polyunsaturated fatty acids may protect against ischaemic heart disease.[1] In the diet and reinfarction trial patients with an acute myocardial infarction advised to eat fish rich in n-3 polyunsaturated fatty acids had a 29% reduction in two year all cause mortality compared with controls.[2] The authors hypothesised that dietary n-3 polyunsaturated fatty acids might reduce malignant ventricular arrhythmias and sudden cardiac death, as reported in animals.[3] We investigated a possible antiarrhythmic effect of dietary n-3 polyunsaturated fatty acids in survivors of myocardial infarction.

Patients, methods, and results

Patients were eligible for study if they had been discharged from the department of cardiology at Aalborg Hospital between November 1991 and August 1993 after a myocardial infarction and had a ventricular ejection fraction below 0·40. We excluded patients aged over 75, patients with pacemakers or permanent tachyarrhythmias, and those with serious non-cardiac disease. Eighty one patients fulfilled the inclusion criteria and 55 gave informed consent to a double blind placebo controlled trial.

Patients were randomly allocated to receive either 5·2 g of n-3 polyunsaturated fatty acids daily (as 4·3 g eicosapentaenoic acid and docosahexaenoic acid, equal to eight capsules of Pikasol, a re-esterified triglyceride (EPAX 5500; Pronova Biocare A/S, Norway)) or olive oil for 12 weeks. Treatment began at the time of allocation. Patients were randomised in blocks of 10 and numbered consecutively. Patients drew treatment

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Table 1—*Heart rate variability in the two groups*

Treatment group	Mean (SD) before	Mean (SD) after	Mean difference (95% confidence interval)
Standard deviation of all normal RR intervals in 24 hour Holter recording (ms)			
n-3 Polyunsaturated fatty acids	115 (39)	124 (30)†	−8·3 (−16 to −1)‡
Control	115 (45)	105 (36)	9·4 (−2 to 20)
Mean RR interval (ms)			
n-3 Polyunsaturated fatty acids	807 (104)	825 (95)	−18·4 (−39 to 3)
Control	823 (187)	827 (175)	−3·4 (−39 to 32)

†P=0·04 *v* baseline.
‡P=0·01 *v* control.

A or B from a sealed envelope and were given capsules packed in boxes correspondingly marked A or B.

Diet and medicines were kept constant during the trial. Compliance was monitored by measuring the incorporation of eicosapentaenoic acid and docosahexaenoic acid into platelets. The trial protocol was approved by the regional ethics committee.

A 24 hour Holter recording was obtained at baseline and at the end of the study. A two channel tape recorder (Tracker Reynolds; Reynolds Medical, Hertford, United Kingdom) was used. All tapes were processed without knowledge of the randomisation code. The end point was heart rate variability. A Reynolds Pathfinder 700 system (Reynolds Medical) was used to analyse the time domain heart rate variability measures mean RR (mean of all normal RR intervals during the 24 hour recording) and standard deviation of all normal RR intervals in the entire 24 hour recording. QRS complexes with abnormal morphology were excluded from analysis.

A paired *t* test was used to compare any heart rate variability differences within the fish oil and control groups, and the groups were compared by non-paired *t* test. The mean RR variable was used to calculate the required sample size. With an estimated standard deviation of 80 ms and type I and type II errors accepted at the 5% level the total sample size should be 52, provided that the smallest difference between the means not to be overlooked was 10%.

During the trial one patient from the control group died, one patient from each group withdrew for personal reasons, two controls were excluded (one developed a ventricular aneurism, one atrial flutter), and one patient in the fish oil group was excluded because of a technically insufficient Holter recording.

The remaining 26 patients in the fish oil group and 23 controls were comparable in age, sex, ejection fraction, qualifying myocardial infarction (size, location, thrombolytic therapy), smoking, hypertension, plasma cholesterol concentrations, and cardiovascular drugs.

Compliance was confirmed by an increase in eicosapentaenoic acid and docosahexaenoic acid in platelets in all patients in the fish oil group whereas no changes occurred among controls (data not shown). The standard deviation of all normal RR intervals in the entire 24 hour recording increased significantly in the fish oil group compared with baseline and control values. The 95% confidence interval of the difference in mean differences in standard deviation of all normal RR intervals in the entire 24 hour recording (with the two groups compared) was −34 to −2 ms. Table 1 summarises the results.

Comment

These findings indicate that n-3 polyunsaturated fatty acids may increase heart rate variability in survivors of myocardial infarction. This may be of clinical importance because an increased parasympathetic cardiac tone reflected by an increased heart rate variability or standard deviation of all normal RR intervals in a 24 hour recording increases the ventricular fibrillation threshold and protects the myocardium against ventricular arrhythmias.[4] In accordance with this a decreased heart rate variability is strongly associated with increased mortality in postmyocardial infarction patients.[5] Furthermore, it is notable that improved long term survival occurs in high risk patients given β blockers or angiotensin converting enzyme inhibitors, both of which increase heart rate variability.[5]

Our study supports the hypothesis that n-3 polyunsaturated fatty acids may have an antiarrhythmic effect in humans, which could in part explain the reduced mortality reported in postmyocardial infarction patients given these acids.[2] Further studies are needed.

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1 Dyerberg J, Bang HO, Stoffersen E, Moncada S, Vane JR. Eicosapentaenoic acid and prevention of thrombosis and atherosclerosis. *Lancet* 1978;ii:117-9.
2 Burr ML, Fehily AM, Gilbert JF, Rogers S, Holliday RM, Sweetnam PM, *et al.* Effects of changes in fat, fish, and fibre intakes on death and myocardial infarction: evidence from the diet and reinfarction trial (DART). *Lancet* 1989;ii:757-61.
3 Charnock JS. Lipids and cardiac arrhythmias. *Prog Lipid Res* 1994;4:355-85.
4 van Ravenswaaij-Arts CMA, Kollée LAA, Hopman JCW, Stoelinga GBA, van Geijn HP. Heart rate variability. *Ann Intern Med* 1993;118:436-47.
5 Stein PK, Bosner MS, Kleiger RE, Conger BM. Heart rate variability: a measure of cardiac autonomic tone. *Am Heart J* 1994;127:1376-81.

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ONE HUNDRED YEARS AGO

SUICIDE MADE ATTRACTIVE.

SIR,—A delightful voyage by an Australian liner was marred two days before we reached Colombo by two suicides. One victim was a steerage passenger 27 years of age; the other a hypersensitive cultured young Oxford graduate. The Oxford man had thrown himself with zeal into all the busy idleness of shipboard life, and we now know that from the start he made a heroic effort to forget his own depression in trying to make the voyage pleasant for others. Reciprocally, many who noticed that he looked worried had unobtrusively endeavoured to arrange occupation and amusement for him.

Neither victim can be held responsible for his act, but what term expresses with sufficient force the wrong-headedness of medical men who send such cases for a voyage? Stupidity is a term far too mild. Practitioners send people suffering from incipient melancholia to sea to cure them of the blues. They give them their whole time to think about their troubles; where by day and by night the sea beckons to them to take one plunge and end them. Every day nearer to the equator the waves become bluer, softer, and more seductive, while the patient's power of resistance grows weaker as his lassitude increases with the temperature.

Owing to the improvements in the accommodation provided on board ship sea travel is rising in favour as a regimen; but it is a pity that so many doctors who prescribe it have little or no personal experience of its conditions. . . .

ALEX HILL,
(Master of Downing).

Kandy, Ceylon, Feb. 18th.

(*BMJ* 1896;i:882.)