

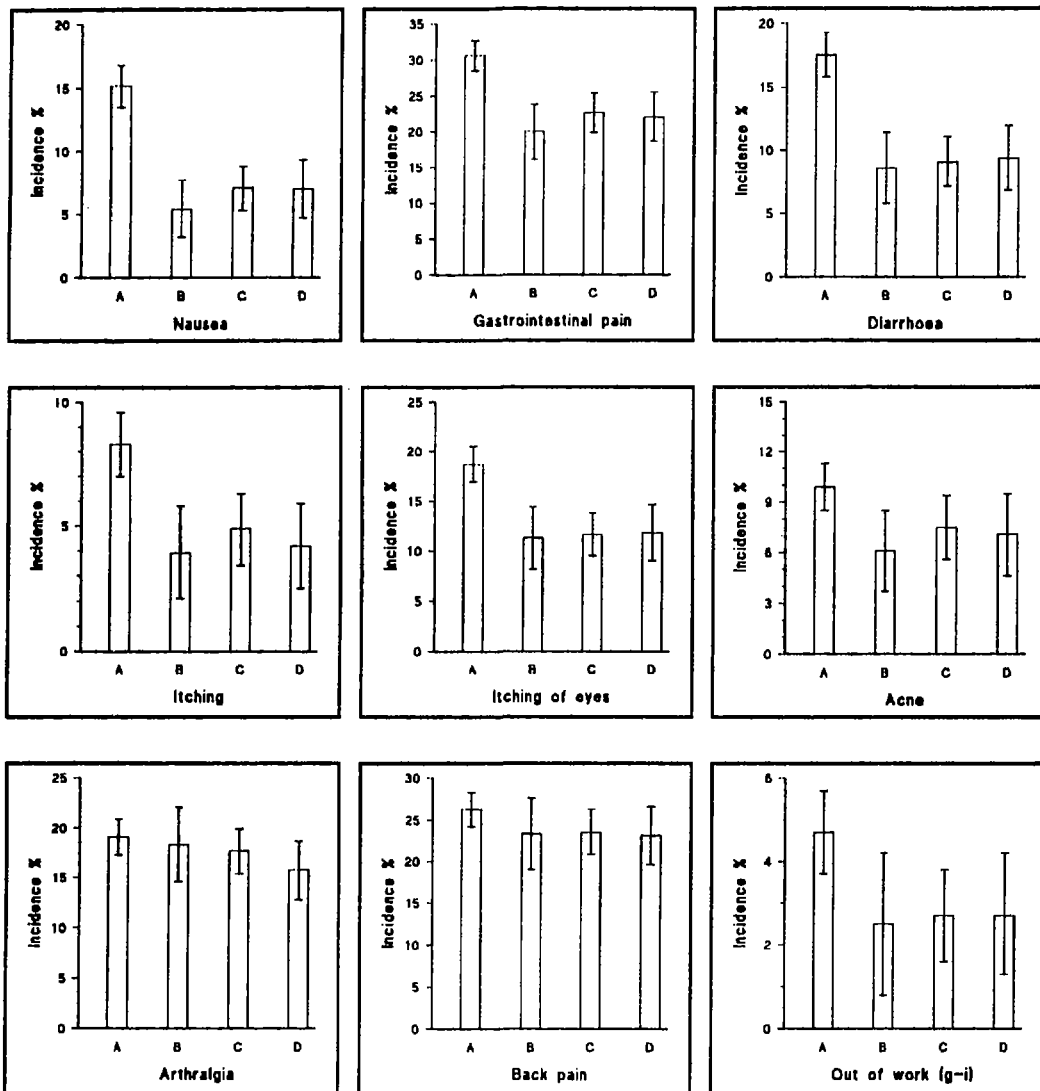
## Long-term chlorophenol exposure causes gastrointestinal and skin symptoms in humans

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In December 1987, a water intake plant supplying groundwater to 3500 people was closed because of chlorophenol concentrations of 70 to 140  $\mu\text{g/l}$ , in Kärkölä municipality in Southern Finland. High concentrations of chlorophenols (100 to 1000  $\mu\text{g/kg}$ ) were also found in fish from Lake Valkjärvi which is a popular local fishing resort. Lake and brook bottom sediments suggested that chlorophenol exposure in the village started in the early 1970s or even earlier.<sup>1</sup> In an exposure study, elevated urinary excretion of chlorophenols was demonstrated in the population,<sup>2</sup> but no increase in PCDD and PCDF concentrations was found in breast milk.<sup>2</sup> Significant increases in non-Hodgkin lymphoma and soft tissue sarcoma were found during the last three five-year periods (1972–1986) in Kärkölä municipality.<sup>3</sup> An association to chlorophenol-related factors such as consuming fish from Lake Valkjärvi or community water was verified in a case-control study for non-Hodgkin lymphoma.<sup>3</sup>

In the present questionnaire study, disease symptoms were studied in the adult population (15 years or older) of Järvelä village of Kärkölä. This village is the distribution area of the contaminated ground water intake plant, and its inhabitants also use fish from Lake Valkjärvi located downstream. Three control areas were chosen, Kärkölä countryside around the village, and one village and one countryside area in the neighbouring Hollola municipality. The number of responders was 1773 in Järvelä, and 1049, 403, and 566 in the control areas, respectively. The response rate was 69% with no difference between the areas. The questionnaire comprised of 156 questions on environmental and sociodemographic parameters (such as housing), exposure parameters (such as use of water or fish, occupational exposure), lifestyle (such as smoking habits and alcohol use), and health parameters (various disease symptoms, drug use, medical consultation etc.). Proportions were age and sex adjusted by the straight method to the Finnish population in 1989 and 95% confidence intervals ( $CI_{95}$ ) calculated.<sup>4</sup>

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**Fig. 1.** Incidence of some symptoms in Järvelä during the previous year as compared with the three control areas (A = Järvelä, B = Vesikansa village in Hollola, C = Kärkölä countryside, D = Vesikansa countryside). Means  $\pm$  95% confidence interval. Panel nine means inability of at least two days to work due to gastrointestinal symptoms during the previous year (n.s.), panel 4, continuous itching, panel 6, acne any time (n.s.), and other panels, at least three times during the previous year.

Several reported symptoms were significantly increased ( $p < 0.05$ ) in Järvelä as compared with any of the control areas (Fig. 1). These could be grouped to gastrointestinal symptoms (panels 1–3) and skin symptoms (panels 4–5). Several other symptoms were increased as compared with one or two control areas, but not all three. These included headache, general malaise, anorexia, eczema, and respiratory infections.

Arthralgia and back pain were assumed not to correlate with chlorophenol exposure, and were therefore selected as control symptoms. No differences between the four areas were found in these parameters (Fig. 1). Other manifestations such as acne, liver injury (diagnosed by physician) and kidney disease (diagnosed by physician) which could have been expected on the basis of occupational experience on chlorophenol exposure, were not significantly increased.

Using data on individuals from all four areas studied, characteristics associated with the risk of different symptoms were explored using logistic regression. A best possible model for each symptom studied was built by including into the model all variables that were significantly associated with the given symptom. An example is shown in Table 1 indicating the risk ratios (odds ratios) related to gastrointestinal discomfort. Total of 3128 individuals, 24% with gastrointestinal discomfort, were included in this analysis.

*Table 1.* Risk ratios for gastrointestinal discomfort in the study population (Järvelä and the three control areas together)

Exposure	Risk Ratio	CI <sub>95%</sub>
Residence in Järvelä village	1.4	1.2–1.5
Use of Valkjärvi fish	1.4	1.1–1.7
Drinking water from Järvelä plant	1.3	1.1–1.4
Bathing in tub at least once a week	1.4	1.1–1.8
Chipboard exposure	1.3	1.2–1.4
Fish meal at least once a week	1.1	1.0–1.2
Glue exposure <sup>1</sup>	1.2	1.0–1.4
Detergent or antiseptic exposure <sup>1</sup>	1.2	1.1–1.3

<sup>1</sup>Occupational or recreational

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These results suggest that a low exposure to chlorophenols may be associated with several reported symptoms. As compared with occupational exposure, the peak exposures are probably lower, but on the other hand, the exposure is likely to have been fairly even and continuous over several years. Reporting bias may affect the results, because the population had previous information on the chlorophenol contamination of drinking water. The control questions on arthralgia and back pain may not completely take care of this problem, since gastrointestinal problems may be more likely to be associated with contaminated water than the control symptoms. However, together with our previous data, which associate chlorophenols to non-Hodgkin lymphoma and soft-tissue sarcoma, it is prudent to assume that chlorophenols may pose a remarkable health risk after a prolonged population exposure.

## *References*

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