

CANCER INCIDENCE IN DANISH PHENOXY HERBICIDE WORKERS 1943-92

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Introduction

The dichlorophenol- and chlorocresol-based phenoxy herbicides have been manufactured since the late 1940s and have been used widely for weed control in growing grains for cereals. The phenoxy herbicides based on dichlorophenols are **2,4-D** (2,4-dichlorophenoxy-acetic acid), **2,4-DP** (2[2,4-dichlorophenoxy]-propanoic acid), and **2,4-DB** (2-[2,4-dichlorophenoxy]-butyric acid). Those based on chlorocresol are **MCPA** (4-chloro-2-methylphenoxyacetic acid), **MCPB** (2-[4-chloro-2-methylphenoxy]-propanoic acid), and **MCPD** (2-[4-chloro-2-methylphenoxy]-butyric acid). In Denmark, the use of these phenoxy herbicides reached a maximum in 1983 with a total of 3,000 tons. This is equivalent to approximately 0.6 kg per inhabitant per year or to 31 kg per person working in farming.

One factory in Denmark (Kemisk Værk Køge) started to produce 2,4-D in 1947 and MCPA in 1949. MCPA soon became, by far, the predominant product, but a variety of other substances also was produced. Manufacture of MCPA was started in a second smaller factory in Denmark (Esbjerg Kemikaliefabrik) in 1951¹⁾. The cancer incidence²⁾ and mortality⁴⁾ have been studied among the 4,400 workers from these two factories for the period 1947-87. The Danish cohort study of employees from two phenoxy herbicide manufacturing plants is the only large cohort study for which cancer incidence data are available. This is in particular important for the identification of soft tissue sarcomas.

Materials and methods

All persons ever employed in either of the two factories from the start of phenoxy herbicide manufacture, until 1981, were included in the study. The cohort included 4,491 persons of whom 4,461 (99 percent) were successfully traced³⁾. They were followed up for death, emigration, and cancer incidence through 1987. The registration of employees was based on personnel files in the two factories and on public pension-scheme records.

Exposure measurement data were not available in past and therefore had to be inferred from the available data on production. MCPA and, later, the 2,4-DP and MCPB were the main products. At Kemisk Værk Køge, during the 1950s and 1970s, up to 50 percent of the MCPA was produced as spray-dried MCPA-sodium salt, which is a very fine powder. Small amounts of 2,4-D and negligible amounts of 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) were produced at Kemisk Værk Køge, whereas these compounds were never produced at Esbjerg Kemikaliefabrik. In addition to phenoxy herbicides, the two factories produced other substances, including various dyes and

RISK I

pigments at Kemisk Værk Køge. Workers in each plant were classified according to potential herbicide exposure based on their work area noted in the personnel files.

The individual risk periods started on the day of first employment. The periods ended on the date of death or emigration, or 31 December 1987, whichever came first. All tumors diagnosed during the individual risk periods were included in the analysis. Expected numbers of cancer cases were based on the cancer incidence rates for the Danish population for sex, five-year age- and calendar groups. Both the observed (Obs) and the expected (Exp) numbers of soft tissue sarcomas (STS) include, in this study, sarcomas topographically coded to the connective tissue as well as sarcomas topographically coded to organs.

Results

In 1943-87, the 940 phenoxy herbicide manufacturing and packaging workers experienced the same overall cancer incidence as the Danish population (observed [Obs] = 66; expected [Exp] = 64.27; standardized incidence ratio [SIR] = 1.0; 95 percent confidence interval [CI] 0.8-1.3). The same was true for the 1,179 workers employed in manual service functions.

A total of five STS cases were observed in 1943-87. Four of the STS cases were observed among persons potentially exposed to phenoxy herbicide (Exp = 1.76; SIR = 2.3; CI = 0.6-5.8). Three of the cases occurred among men employed for at least one year in one factory. In this subgroup, an SIR of 6.4 (CI = 1.3-18.7) was observed when a 10-year latency period was taken into account. Persons potentially exposed to phenoxy herbicide had an incidence of non-Hodgkin's lymphoma close to that of the Danish population (Obs = 4; Exp = 3.08; SIR = 1.3; CI = 0.4-3.3).

Discussion

Based on small numbers, this Danish study in 1943-87 continued to add to the evidence for a possible association between phenoxy herbicide exposure and risk of STS. It should be noted that the main exposure in the two factories has been to MCPA which is not contaminated with TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin). The present study did not support an association between phenoxy herbicide exposure and subsequent risk of non-Hodgkin's lymphoma.

Updated data for the cohort for 1988-92 will be presented at the conference.

References

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