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Solvent-induced encephalopathy in the Netherlands and Finland

Long-term occupational exposure to organic solvents may result in the development of a brain disorder, known as chronic solvent-induced encephalopathy (CSE). A brief history of the process of recognition and the driving forces behind it, the resistance in the scientific and political context and how recognition aided preventive actions in Finland and the Netherlands is instructive.

It took many years before CSE was accepted and recognized as an occupational disease. In the 1970s and 1980s, there was growing awareness, especially in the Nordic countries, that there was a distinct pattern in symptoms and complaints reported by workers related to long-term solvent exposure. Evidence for chronic adverse brain effects related to occupational solvent exposure began to emerge in the early 1960s when the Finnish neuropsychologist Helena Hänninen published a paper about the psychological performance profile in occupational intoxications [1]. She proposed this 'psycho-organic syndrome' or 'organic solvent syndrome' as a new occupational disease. The body of CSE evidence increased in subsequent years and showed adverse neurological effects in workers exposed to solvents. Various manifestations and findings in neuropsychological, neuroimaging, neurophysiological and neurological examinations endorse a central nervous aetiology.

The hallmark of CSE is the cognitive dysfunction whose characterization requires neuropsychological assessment. It is one of the cornerstones in the diagnostic and differential diagnostic procedure for CSE with non-specific symptoms resembling clinical features of many non-occupational conditions. In many countries, there has been reluctance to use neuropsychological methods in occupational health. Therefore, the existence of so-called 'painters disease' was considered as 'pseudo-neurotoxic disease' by some scientists and physicians [2].

International peer support helped in the process of recognition. The World Health Organization (WHO) organized a symposium in which long-term effects of organic solvents on the central nervous system and a classification with diagnostic criteria were formulated [3]. Twelve years later, a publication in the *Lancet* [4] helped spread knowledge on the neurotoxic effects of chronic solvent exposure in workers to a wider clinical community. This

emphasized that the assessment of patients with suspected CSE requires a multidisciplinary approach as underlined in the European consensus document on the cognitive and neuropsychological criteria for CSE [5].

Parallel with the scientific recognition, public concerns on this issue were raised in some countries, e.g. the Netherlands through the visibility of patients in the media and questions in parliament. Patients' organizations, supported by unions, played an important role in generating publicity and galvanizing policy-makers to action. In the Netherlands, the role of industry was interesting. Manufacturers, in the paint and ink industry, recognized the risk of CSE at an early stage and they were the first to introduce screening programmes for their workers. On the other hand, the painters employer's organization denied the existence of the disease in public debate and was strongly opposed to the implementation of any preventive measures. In Finland, the legislation and occupational healthcare system enabled the clinical recognition of CSE as an occupational disease from 1978. Since 1990, CSE has been recognized as an occupational disease in the European list of occupational diseases, with a supporting document as a guide for diagnosis [6]. It is also included in the 2009 ILO list of occupational diseases.

A substantial reduction in the occupational exposure to solvents has been achieved in recent years in several Western European countries, as a result of a series of legal measures and agreements at economic sectoral level. In the Netherlands, a governmental ban on the use of solvent-rich paint and glue for indoor activities was implemented in 2000. Through screening, new cases of CSE were detected at an earlier stage of disability both in Finland and in the Netherlands [7,8]. The recognition of these workers leads to reduction of their solvent exposure which is likely to reduce the progress of adverse brain effects if they do remain at work.

In the meantime, the number of new cases of CSE fell to <5 cases/year in Finland (workforce 2.5 million) and to <10 cases/year in the Netherlands (workforce 7.0 million). Figures 1 and 2 show the numbers of referrals to the 'solvent teams' and the number of patients diagnosed with CSE in Finland and the Netherlands. The solvent teams consist of specialists in occupational medicine, neurology, neuropsychology, industrial hygiene and possibly consultation with a psychiatrist. The referral can be done by any doctor, often by an occupational or general health physician. Figure 2 shows a surprising finding from Finland where a screening project [7] directed to workers in occupations with heightened risk of CSE led to a spike in the incidence in 2012–13. The preserved work ability of these CSE cases suggests an earlier recognition of cases which would have been detected later or missed by more normal occupational healthcare. In the last decade in Finland, CSE has been shown to have a later onset and milder cases, suggesting success in the preventative actions, mainly the reduction of exposure levels at work [9]. Similar findings

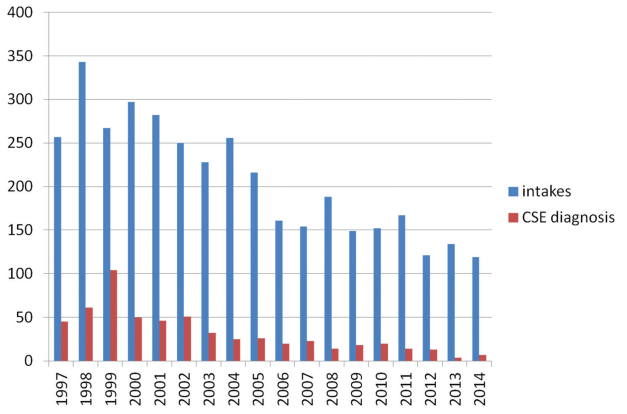

Figure 1. Referred and diagnosed chronic toxic encephalopathies (CSE cases) in the Netherlands during 1997–2014.

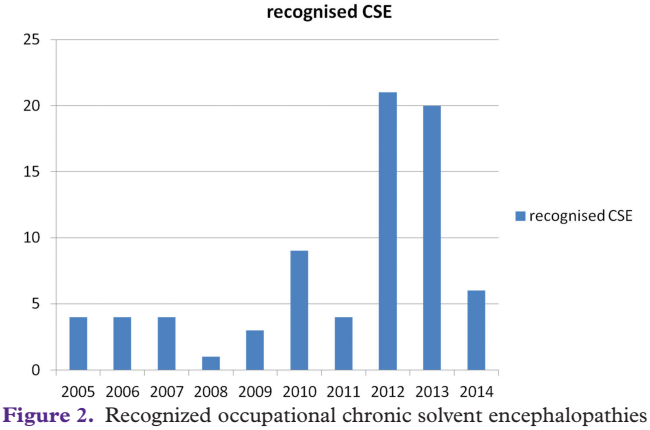

Figure 2. Recognized occupational chronic solvent encephalopathies at the Finnish Institute of Occupational Health in 2004–14.

have been encountered in other Nordic countries. In the Netherlands, the more recent detected patients have been working in 3-D jobs: dirty, dangerous, demanding, especially in sectors that are underserved with proper occupational healthcare or in relatively new work areas such as artificial nail studios.

Driving forces in the process of recognition were scientific progress, active scientists with international collaboration and public action, generated by convincing case reports and visibility of sufferers in the media. This growing awareness prompted policy-makers and labour inspectorates to enforce prevention. CSE is now more widely recognized as an occupational disease and embedded in the European and ILO list of occupational diseases. CSE is not a major European problem anymore because of the introduction of much stricter regulations and the dubious practice of outsourcing of production facilities with unhealthy jobs, such as footwear manufacturing, to countries like India, China and South East Asia. In some countries, like South Korea, the health and safety authorities are aware of this problem and take action to prevent CSE [10]. Worldwide, control of exposure and occupational health surveillance of the early neurotoxic effects of organic solvents is still needed. This example of CSE shows the importance of recognizing work-related diseases to accelerate preventive measures.

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Sentinel surveillance and occupational disease

Improving collection and analysis of data to measure trends in occupational diseases (ODs) has long been, and continues to be, a strategic aim of past and future European Union strategies for health and safety at work. Precision in terminology has traditionally influenced the gradual growth of science, including in the discipline of medicine. Definitions evolve over time reflecting contemporary scientific thinking and developments shaped by social, political and academic factors [1].

Sentinel surveillance systems in occupational health involve the ongoing and rapid identification of sentinel health events (cases and their corresponding occupational risks) for purposes of follow-up and for developing statistical trends [2–4]. The goal of such surveillance systems is to enhance case reporting, identify risk factors and high-risk work sites and link preventive interventions to work sites and the broader community [5].

The under-reporting of compensable and non-compensable work-related health problems by physicians is a well-documented phenomenon. Improving the reporting by physicians to surveillance systems in general and particularly health problems attributed to new and emerging risks is a central objective for MODERNET [6]. In the MODERNET consortium, we looked specifically at the term 'OD' as it is applied to sentinel surveillance systems and examined if the term facilitates or hinders reporting of work-related health problems to surveillance systems.

The ILO (International Labour Organization) and European commission (EU commission) are significant institutions that contribute to policy development in occupational health.

In Europe, the EU commission continues to influence methods of statistical data collection that provide better evidence and monitoring tools for the prevention of work-related diseases by tackling new and emerging risks without neglecting existing risks. Better terminology to assist policymaking as it concerns workers health is vital. The scientific community must remain mindful of the importance of the coordinating role of the international institutions such as the ILO, the World Health Organization (WHO), European Union and the Organization for Economic Co-operation and Development (OECD) on shaping occupational health practice.