

Unintentional Carbon Monoxide Poisoning in Dwellings: A pilot study in two countries

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SUMMARY

Unintentional Carbon Monoxide poisoning in dwellings is recognised as a serious public health problem and countries have adopted policies and practices aimed at reducing the likelihood of exposure to potentially dangerous levels of CO. While scientific knowledge about the health effects can be readily exchanged, the transfer of effective policies and actions between countries is more problematic. The policies and practices in France and England are reviewed with the aim of identifying good practice that could be transferable. The study also looked at information collected that could inform preventative policies and practices. The project provides a framework and foundation for the comparison of policies, practices and actions in other countries.

KEYWORDS

Carbon Monoxide Poisoning, Dwellings, Preventative Policies, France, England.

INTRODUCTION

Carbon monoxide is a toxic gas. At high concentrations, inhalation of CO can cause unconsciousness and death. These acute health effects are well documented (eg, Kao and Nanages, 2006; and Cho et al, 2008), and most European countries have adopted the World Health Organization (WHO 1999) and the Expert Panel on Air Quality Standards (EPAQS) guidelines and standards for CO. At lower concentrations, inhalation of CO can cause a range of symptoms from headaches, dizziness, weakness, nausea, confusion, and disorientation, to fatigue; all symptoms easily confused with those caused by illnesses such as influenza, and with depression. It is unclear what effects occur from long-term exposure to much lower, but above normal, concentrations of carbon monoxide. Many of the reported symptoms, including impairment of attention span and short-term memory loss, appear to be related to, and be symptoms of, damage to the central nervous system. While countries may have information on the number of reported deaths attributable to CO poisoning, because of the possibility of misdiagnosis of non-fatal cases, the total burden of CO poisoning is uncertain.

The main potential source of CO within dwellings is from the incomplete combustion of all fuels containing carbon, including gas, oil, and solid fuels. This may be caused when an appliance is malfunctioning or misused, or because combustion products (including CO) spill back into rooms where there are defects to flues or where there is a negative pressure (eg, from an over powerful extract fan). In addition, flueless gas or oil heaters discharge the combustion gases direct into the internal atmosphere, and, even in well ventilated rooms, these are likely to produce CO concentrations above safe levels.

METHODS

For each country, information on the policies, practices and personnel involved in surveillance, prevention and investigation was collected and compared. This information was reviewed having regard to the legal and administrative environment of each country. Reports and documents produced by relevant agencies, particularly government bodies, were reviewed to distil information on the scale of the problem, and the policies and practices directed at investigating the causes of this major public health problem. In addition, key personnel involved were interviewed.

FINDINGS

France

There are several thousands hospitalisations and more than one hundred deaths attributable to CO poisoning each year. Efforts to monitor all the incidents were reinforced recently as the previous reporting system was considered to underestimate the problem. At the request of Direction Générale de la Santé (DGS), a national surveillance system was implemented in 2005 under the responsibility of Institut de Veille Sanitaire (InVS). This system is based on the reporting of all cases suspected to be CO poisoning and the introduction of environmental and clinical questionnaires. Following the introduction of this new system, 1,682 cases of CO poisoning were reported in 2006, of which 1,069 cases occurred in dwellings. Where symptoms were observed these were headache (75.9%), nausea (39.9%) and dizziness (28.7%); 62% of the cases underwent an emergency outpatient consultation (Verrier et al, 2008). A number of improvements are still recommended for data collection, including changes in the methods for estimating the number of fatalities.

In the Greater Paris region, 214 cases were reported in 2005, most of which occurred in the home (69%), and were usually reported by firefighters or analytical laboratories (respectively 33% and 47%) (InVS, 2007). Of the 659 victims, 313 (48%) of them were admitted to hospital. A total of 30 deaths were reported, 9 of which were confirmed after a medical enquiry. A thorough investigation of environmental factors was conducted in more than 80% of the cases occurring in the home, and the cause of the poisoning was identified for 95% of these. The cause was often a combination of faults and circumstances: inadequate extraction of exhaust gases (53% of cases), faulty devices (52%) or unsafe use of makeshift portable heaters (20%). The inspection of dwellings to determine whether they are 'insalubrious' includes the assessment of the fuel burning appliances and measurement of CO in the indoor air and flue gases, using a CO Toximeter (DGS/ANAHA, 2005). These inspections are carried out by surveyors instructed by DGS, Agence nationale de l'habitat (ANAHA), or the local authority.

England

Various bodies collect data on CO poisoning, including the Health and Safety Executive (HSE) and the Health Protection Agency (HPA). As the HSE has responsibilities for fuel gas safety, it is primarily concerned with CO poisoning attributable to gas appliances. Figures from the HPA suggest that there are on average 50 fatalities and 200 recorded cases of non-fatal injury from CO poisoning each year.

It is usually the police or the Fire and Rescue Service that will be called to a suspected incident, and where it appears to be a problem of CO poisoning, the Gas Emergency Service will be called to check the appliance. If it is confirmed that it is a case of CO poisoning, the gas supplier has a duty to look into the cause. If there has been a major injury or fatality, the details are given to the HSE who will investigate to check whether there has been a breach of

any law relating to the installation or maintenance of a gas appliance. Where a dangerous gas appliance is found, a gas engineer may carry out a flue gas analysis test. Such tests are not common practice for basic appliance faults, but are general practice as part of the investigation of CO incidents.

Rarely will a report come directly from a GP or from Accident/Emergency department of a hospital. However, as the symptoms of CO poisoning are often confused with other causes, it is suspected that these figures are an underestimation, and the HPA has recently issued advice to encourage medical personnel to be more aware of CO poisoning symptoms (HPA, 2009). The design and construction of new dwellings is controlled by codes enforced by local authorities. These regulations include controls on the safe venting of the products of combustion of any appliance to the external air and on ensuring an adequate supply of air for combustion purposes. There are similar controls on the installation of new appliances in existing dwellings. In addition, all work associated with fuel gas and gas appliances (although not appliances using other fuels) is required to be carried out by personnel registered with the Gas Safety Register (previously the Council of Registered Gas Inspectors, CORGI). Local authorities have responsibility for identifying and dealing with unsatisfactory housing conditions, including conditions that may increase the likelihood of exposure to unsafe levels of CO. However, the assessment of appliances is purely visual, such as looking for evidence of incomplete combustion, or signs of inadequate air supply and ventilation (ODPM, 2006).

Annually in England there is at least one campaign promoting awareness of the dangers of CO. Perhaps surprisingly, although such campaigns can be expensive, there appears to have been no attempt to assess the effectiveness of such campaigns in increasing knowledge of the dangers of CO and in influencing behaviour.

DISCUSSION

Recognising the problem of unintentional CO poisoning, both France and England have adopted policies and practices to attempt to prevent the occupiers being exposed to potentially dangerous levels of CO in dwellings. However, the nature of those policies, practices and actions has been influenced by various factors, including the legal and administrative environment of the particular country. This has meant that different bodies and individuals have been given responsibilities and duties for the collection of data, for identifying incidents, for responding to and investigating those incidents, and for enforcing standards. In both countries there are several agencies and bodies involved in data collection, investigation and preventative actions and the coordination could be improved. There are also differences in the gas industries. In England there has been a competitive environment for some time, with a separation of the gas transporters (the companies responsible for the infrastructure) and the gas suppliers (the companies delivering gas to consumers). Until recently, there was a monopoly in the supply of energy in France, but in July 2007 the market was opened to competition.

Some policies and practices are not transferable. For example, in England, as responsibility for the maintenance of existing appliances rests with the owner of the dwelling (for rented properties this is the landlord) it has been possible to place duties on landlords requiring annual inspection and testing of the appliances. In France, the maintenance of such appliances is the responsibility of the occupier no matter what the form of tenure, so no duties can be placed on landlords. Other policies and practices are transferable and information can be readily exchanged, such as the French practice of using CO Toximeters when assessing dwelling conditions rather than relying solely on visual evidence as in England. Both

countries are studying the reliability and effectiveness of CO Detectors, but although they are recommended in England, neither country has made their installation obligatory.

In theory, it is possible to suggest certain characteristics of appliances, dwellings, and households that will increase the likelihood of exposure to unsafe levels of CO. For example, older appliances without safety cut-off devices and with open flues, inadequate ventilation, and perhaps low socio-economic status (increasing the likelihood of a poor maintenance). Collecting data on such characteristics could be used to inform preventative policies, but as yet there is no evidence that this is the case. The data obtained in responding to identified cases of CO poisoning should include the characteristics of the appliances, such as age, type and maintenance record, and of the household, including socio-economic status. In addition, in England information on the age and type of appliances is collected as a part of the English Housing Survey (previously, the English House Condition Survey). However, this information is not currently used to inform policies and is not made available publicly. The changes introduced in France on identifying and recording cases of CO Poisoning provide an opportunity to use that data positively.

CONCLUSIONS AND PERSPECTIVES

This is a pilot study, and it has shown that, even though there are differences in the legal and administrative environment between France and England, there are some policies and practices that could be adapted and adopted by the other country. In addition, the apparent greater coordination and analyses of data in France has provided details on the underlying causes of CO poisoning. There are considerably more recorded cases of CO poisoning in France, but what is not clear is whether this is a result of better reporting, diagnosis, and identification of cases, or because there are more problems. Perhaps unsurprisingly, the causes of CO poisoning appear to be a combination of faults and behaviour. This confirms that to be effective, policies and practices should be directed at both the safety of appliances and installations, and the awareness and behaviour of occupiers. More use should be made of data collected on the characteristics of appliances and households to inform preventative policies.

REFERENCES

- Cho CH, Chiu NC, Ho CS, Peng CC. 2008. Carbon monoxide poisoning in children. *Pediatr Neonatol.* Aug;49(4):121-5.
- DGS/ANAHA. 2005. Formation Grille Insalubrite. Paris: Direction Générale de la Santé/ Agence nationale de l'habitat
- InVS. 2007. Intoxications au monoxyde de carbone dans la région Ile-de-France en 2005 (Carbon monoxide poisonings in the Ile-de-France region in 2005). Paris: Institut de Veille Sanitaire .
- HPA. 2009. Diagnosing Poisoning: Carbon Monoxide (CO). London: Health Protection Agency. <http://www.hpa.org.uk/carbonmonoxide> (accessed 13 April 2009)
- Kao LW, Nanagas KA. 2006. Toxicity associated with carbon monoxide. *Clin Lab Med.* Mar;26(1):99-125.
- ODPM. 2006. Housing Health and Safety Rating System: Operating Guidance. London: Office of the Deputy Prime Minister.
- Verrier A et al. 2008. Les intoxications au monoxyde de carbone survenues en France métropolitaine en 2006 (Carbon monoxide poisoning in France in 2006). *Bulletin Epidémiologique Hebdomadaire.* Nov 2008 44:425-427.
- WHO. Environmental health criteria 213:carbon monoxide (2nd edition). Helsinki: World Health Organization; 1999.