Guest editorial

Smoke alarms, fire deaths, and randomised controlled trials

Each year about 300 000 people die in fires.[1] Most of these deaths occur in the home and children and the elderly are at greatest risk.[1] The absence of a smoke alarm is a strong risk factor for death in the event of a house fire.[2] In some countries, there has been a substantial increase in the proportion of households with smoke alarms over the past two decades. In England and Wales, the proportion of homes with alarms increased from 0% in 1985 to 75% in 1995. This increase in alarms coincided with a substantial fall in fire deaths, although a number of factors apart from smoke alarms might have been responsible for the decline.[3] Despite the overall increase in smoke alarm use, ownership is substantially lower (less than 50%) in disadvantaged inner city neighbourhoods and among families living in rented accommodation.[4] Because the risk of fire and fire related injury is greater in rented and inner city accommodation,[5 6] increasing the prevalence of functioning smoke alarms in these homes may have a disproportionate effect on the occurrence of fire deaths and injuries. This would also have the potential to reduce socioeconomic differentials in mortality. The social class gradient for deaths due to residential fires is steeper than for any other cause of death in childhood. The death rate from fire and flames for children in social class V is 16 times that of children in social class I.[7] A non-randomised controlled trial reported a substantial reduction in fire related injuries associated with a programme to giveaway smoke alarms in a materially deprived area of Oklahoma City.[8]

Two papers in this journal have addressed the problem of increasing smoke alarm use. DiGuiseppi *et al* reported a smoke alarm giveaway programme conducted in two deprived inner London boroughs.[9] Over 20 000 smoke alarms were distributed door to door in randomly selected wards by a coalition of statutory and voluntary agencies. The effectiveness and cost effectiveness of the programme in preventing fires and fire related injury is being evaluated in a randomised controlled trial. A paper in this issue by the ISCAIP Smoke Detector Legislation Collaborators addresses a second strategy for increasing smoke alarm installation, summarising smokes alarm laws internationally (p 254). Many countries have enacted comprehensive smoke alarm laws. One controlled observational study found an association between residential smoke alarm legislation and a reduced likelihood of fire death, but the effectiveness and cost effectiveness of smoke alarm legislation in preventing fire deaths and injuries has yet to be adequately evaluated.

Smoke alarms are relatively inexpensive, but to install alarms in all inner city homes and to ensure compliance with any legislation would have important resource implications. If this had little or no effect on the prevention of fire deaths and injuries, then such a policy would incur an important opportunity cost. But is a scenario plausible where the costs of increasing smoke alarm ownership outweigh the benefits, given the evidence of benefit from ecological,[3] case-control[2] and non-randomised intervention studies[8]? The answer must surely be yes. Results from ecological studies do not constitute reliable evidence of the effectiveness of smoke alarm interventions. Confounding by factors related to poverty might easily account for the strong association observed in case-control studies, because poverty is a strong risk factor for fire death and poor families are least likely to have smoke alarms. Similarly, the 80% reduction in serious fire related injuries seen during the four years after the Oklahoma City giveaway programme must also be considered with caution.[8] It is well established that non-randomised studies can overestimate the effectiveness of interventions when compared with results from randomised controlled trials.[10]

Neither giving away free smoke alarms nor enacting legislation requiring alarm installation in materially deprived areas will necessarily increase the prevalence of *functioning* alarms. A survey of inner London public housing found that only half of installed smoke alarms were functioning.[11] In most cases of non-function, the installed alarms had no batteries. Tenants may remove batteries because of nuisance alarms during cooking and smoking. Such nuisance alarms may be particularly problematic among families living in bed-sit accommodation and in overcrowded conditions. However, failure to maintain a functioning smoke alarm does not signal a feckless disregard for safety. Although residential fires are a leading cause of death in childhood, for families living in the inner city slums there are many competing concerns. One inner London health authority asked residents about their concerns for health and safety in the context of an urban regeneration programme.[12] Discarded syringes from heroin use and used condoms from prostitution were the main fears, and the residents called foremost for improved refuse collection. Given these concerns—and the daily privations of squalid inner city housing, such as broken windows, urine in the stairwells, lifts that do not work, racist graffiti, and violence—it is not hard to understand why smoke alarms are not top on the list of priorities. Clearly, without reliable evidence of effectiveness and cost effectiveness, smoke alarm giveaway programmes or legislation run the risk of diverting scarce resources from other important concerns that may have greater benefit to the population.

Randomised controlled trials are the gold standard for the evaluation of healthcare interventions. There is no good reason why interventions to prevent fire injury should not be evaluated in the same way. Smoke alarms are only one approach to the prevention of fire deaths and injuries, but a particularly promising one. Some countries and states mandate the use of smoke alarms, others do not. On the basis of the existing evidence it is easy to make an argument for smoke alarm legislation, but it is also an easy argument to refute. Reliable evidence from large scale randomised controlled trials of smoke alarm interventions could change this. The Salk vaccine trial reliably established the effectiveness of polio vaccine and laid the foundations for the current efforts to eradicate polio.[13] Our aspirations for injury prevention should be no less.

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ISCAIP report

Our responsibility to children and adolescents

A child falls from an open apartment window without a window guard and suffers a severe, disabling head injury. A teenager amputates his finger while operating machinery at work. A family of four small children are severely burned in a house fire because their rental tenement did not have a smoke alarm. Each of these patients is treated in a hospital; each is left with permanent disability.

A child is admitted to the hospital with bloody diarrhea and develops renal failure secondary to the hemolytic uremic syndrome, and requires renal dialysis. This child's illness is caused by an infection with *Escherichia coli* 0157 H7, the source of which is unpasteurized apple juice sold at a local fair.

In this latter instance, few physicians would hesitate for more than a millisecond in calling the local health authorities to report this source of contaminated juice once it was discovered. The local health authorities would also not hesitate to close down that producer until the source of the contamination was determined and the problem rectified. This is simply good "public health practice" and has resulted in dramatic reductions in morbidity and mortality from infectious diseases during this century.

Should the same action occur for the injury problems described? Should physicians and hospitals give this information to health authorities, and should these authorities in turn investigate and take action? Is the threat to the public's health sufficient to warrant using patient identifying information? Is it the physician's responsibility to be concerned about hazards that result in injuries? Does the fact that the cases all involve minors make a difference in whether or not such information can and should be used?

These questions have been pointedly raised in a recent debate in the pages of the *BMJ*. Lyons, Sibert, and McCabe discuss an injury surveillance system in Wales established by the local health authority based on data from accident and emergency department visits.[1] High injury areas were identified from the data and community based programs were initiated. One common source of injuries was houses in multiple occupation. Local authority officers could potentially work with the landlord in various ways (collegial as well as adversarial) to correct the hazards. The identifying information in the surveillance system consists of postcodes that contain an average of 14 contiguous addresses. However, the director of public health objected because giving this information might violate patient confidentiality as protected by the "Data Protection Act". Thus, as the authors state, "We are now left in a position of knowing where childhood injuries occur but of not being allowed to pass information on to public bodies".[1]

In accompanying articles, the public health director defends his actions,[2] and is backed by articles from a solicitor[3] and an ethicist.[4] Their arguments are that (a) release of such information violates the Data Protection Act, (b) such action would jeopardize the tenants by placing them at risk for eviction by the landlord, (c) it wouldn't do much good anyhow because motor vehicle crashes and poisonings account for the vast majority of deaths, (d) it is not sufficiently in the public's interest to know the location of these injury hazards, (e) these kinds of environmental hazards are not the doctor's responsibility, and (f) where people live is largely a matter of their own choice.

I believe these arguments embody why the International Society for Child and Adolescent Injury Prevention was established (and why a parallel or integrated society for adult injury prevention is needed). They ignore the now large body of scientific information accumulated over the last two decades that constitutes the injury field, the responsibilities of governments to apply this knowledge to prevent harm from trauma, and the special vulnerabilities of children and adolescents. These arguments are also not limited to the discussion of child injury prevention in the UK, but are relevant to the prevention of adult injuries in countries around the world.

Injuries are cased by a complex interplay of agent, host, and environment. Environmental hazards are especially important in the etiology of child and adolescent injury where the limited experience and judgment of children and adolescents cannot counter the effects of environmental hazards such as open windows, unguarded machinery, or sleeping in a home without a smoke detector. Interventions focused on environmental modification have been some of the most powerful tools in the injury prevention armamentarium. They have played a large part in the reduction of deaths due to injury over the last few decades.

These changes in the environment have not necessarily come easily, and have often required government intervention to insure their widespread use and protection