Repairing the nuclear industry

Nuclear fission generates over 25 per cent of the electrical power in the UK. In France this proportion is greater than 70 per cent. Throughout the world there are 31 countries operating about 440 civil nuclear power systems to generate electricity.

As might be expected, throughout the operating life of nuclear plants there will be a requirement to replace or repair engineering components. For example, main reactor pressure vessels are made from steel sections that are welded together, as are the pipes that transmit steam from the reactor to the steam turbines. Due to the molten weld metal cooling and contracting, welding introduces stresses near the weld itself which can become a place of weakness.

It is clearly vital that the magnitude of these residual stress fields is known, but with so many variable parameters in processes such as welding, it is extremely difficult to quantify their amplitude and spatial distribution. Much of the research in the Solid Mechanics Group in the Department of Mechanical Engineering has been devoted to understanding how the presence of the residual stresses influences the fracture of steels. For example, the novel deep hole drilling method, developed at Bristol, provides complete, through-thickness measurements of residual stress which can be used to validate numerical models. Such measurements have now been performed on many large industrial applications – the wing of the new Airbus A380, offshore pipelines, and safety-critical components from a nuclear power plant are just a few examples.

The repair or replacement of these components is a very cumbersome, costly and time consuming exercise which is responsible for long plant shut-down time and the corresponding loss of electricity production. For example, in the case of a nuclear reactor the lost revenue is in the order of 3.5 million euros per week. Here at Bristol we are continually looking at how we can use our expertise to develop novel methods for *in situ* monitoring of engineering components. This will enable us to assess the life of the component in much the same way as we have regular health checks. ■

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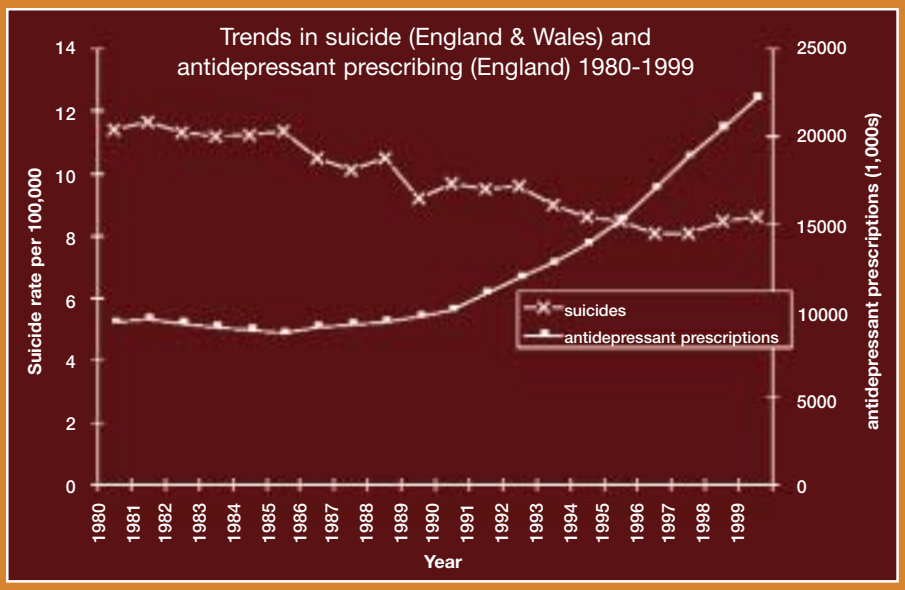
The risks and benefits of taking antidepressants

David Gunnell, Professor of Epidemiology in the Department of Social Medicine, is a member of the Expert Working Group looking into this highly charged issue. He is advising Britain's Medicine and Healthcare products Regulatory Agency on a large study looking at the possible links between some types of antidepressant and suicide.



The results of some unfavourable industry-run drug trials may have been suppressed

Levels of antidepressant prescribing in Britain and many other countries have more than doubled in the past 10 years. Over 28 million prescriptions were issued in 2002 and this continues to rise. Around one in 25 adults in Britain is taking antidepressants at any point in time. The increased level of prescribing is largely due to greater use of a new class of antidepressant – the Selective Serotonin Re-uptake Inhibitors (SSRIs), of which the best known is Prozac (fluoxetine). Recent reports have suggested that levels of prescribing of some SSRIs are so high in Britain that residues have been detected in the water supply.

One interpretation of this rise in prescribing is that it signals an improvement in the detection and management of depression by GPs. Indeed, it has been suggested that recent declines in suicide in Scandinavia, Australia and elsewhere are due to this increased use of antidepressants. But is this interpretation correct? Against this background of optimism there is growing concern that these antidepressants may, in some susceptible individuals, *precipitate* suicidal behaviour. A recent review of evidence from paediatric anti-depressant trials led the Medicine and Healthcare products Regulatory Agency (MHRA) in Britain to issue warnings about their use in treating children and adolescents.

Sifting through the evidence is problematic as much of the research into the effectiveness of antidepressants is industry-sponsored. The pharmaceutical industry tends to present the findings of its drug trials in a more favourable way than when such studies are conducted by independent researchers. Furthermore, it has been suggested that the results of some unfavourable industry-run drug trials may have been suppressed – a finding borne out by a recent review of paediatric antidepressant trials, where the risk–benefit balance was altered when unpublished trials were included in an overall assessment.

Benefits of SSRIs include fewer side effects than the older types of treatment (tricyclic antidepressants); furthermore, they are less toxic when taken in overdose and thus may lead to the prevention of some overdose deaths. There is, however, little direct evidence that antidepressants prevent suicide. In part this is because, thankfully, suicide is rare and trials would need to recruit many thousands of patients to reliably detect any reduction in suicide. So in the absence of clear evidence from clinical trials, researchers have investigated whether rises in antidepressant prescribing are associated with reductions in suicide. The good news is that in Britain suicide rates are declining and so, if there is an adverse impact of antidepressants on suicide rates, it is likely to be small as suggested by recent favourable trends (see figure). Of note is the fact that this decline in suicide predated the increase in antidepressant prescribing.

From the population perspective the 'balance sheet' of risks and benefits of SSRIs is unclear. Although any suicide is one too many, it is important to assess whether any 'antidepressant-induced' suicide is offset by the beneficial effects antidepressants may have on the risk of suicide associated with untreated depression. As existing trials are small and have only followed up patients for short periods of time, such benefits, although intuitively likely, have not been proven. The balance of risks and benefits may vary depending on an individual's underlying suicide risk. For conditions such as severe depression, with high risks of suicide, the risk–benefit balance may be more favourable than for conditions such as anxiety and mild depression where suicide is rare. It is for these latter conditions, however, that much of the recent rise in prescribing has occurred.

The findings of the MHRA investigation into the safety of antidepressants are expected soon, but further research is urgently needed to identify those patients at greatest risk of side effects, and those conditions where the balance of risks to benefits is unfavourable. Furthermore, an assessment of the long term implications for population health of high levels of antidepressant prescribing is crucial. ■

Further research is urgently needed to identify those patients at greatest risk