

DOES THE PHARMACEUTICAL INDUSTRY NEED A NEW PRESCRIPTION?



Professor Michael H Depledge
European Centre for Environment
and Human Health, Peninsula
College of Medicine and Dentistry
(Universities of Exeter and
Plymouth)

THE BACKGROUND

The pharmaceutical industry is widely regarded as being vitally important to the UK economy. It directly employs 72,000 people and indirectly a further ca 200,000. In 2009, the sale of pharmaceuticals generated a trade surplus of almost £76 billion; more than any other major British industry. So it is not surprising that when signs of a decline emerge there are clarion calls to do something.

The Royal Society of Chemistry has urged more government investment and the development of a sustainable funding model. They argue that this will stimulate growth, liberate associated economic

benefits, strengthen the science base and permit exploitation of biology to revitalise biotechnology. Additional economic arguments have also been deployed to justify stimulating recovery following the global economic downturn. For example, new medicines might reduce the cost of healthcare in the future. If drugs could be used to delay the onset of Alzheimer's disease, it has been estimated that this might save Medicare and Medicaid in the USA \$447 billion per year by 2050.

But when such claims are made they present only one side of the argument. For example, some drugs have had to be withdrawn because they caused unexpected morbidity and mortality, even though they had previously successfully passed through Phase III clinical trials. In 2010, the widely used anti-diabetic drug Avandia had restrictions placed on its use and is now the subject of 13,500 lawsuits.

Another example of a cost to society is provided by some UK research councils, such as the MRC, who use taxpayers' money to help fund research into new medicines which are then exploited by the pharmaceutical industry; while others, such as the NERC and the ESRC, use even more taxpayers' money to support research into the adverse effects of these and other pharmaceuticals on the environment and human wellbeing.

PHARMACEUTICAL ECONOMICS AND LIFE EXPECTANCY

There is no doubt that some pharmaceuticals have improved the quality and duration of many people's lives. The treatment of infectious diseases was revolutionised by antibiotics, and the most prevalent killer diseases, cardiovascular disease and cancers, are now being tackled, often very effectively, through drug treatment. The costs to health care systems however are immense. In 2008 the NHS prescription drug bill was £8.2 billion having doubled in a decade. Both prescription and non-prescription drug use increase exponentially as we get older because of a rise in the prevalence of chronic diseases and a greater likelihood that more than one disease will occur in a particular individual. Based on current prescribing practices, the Office of National Statistics predicts that the volumes of medicines used could double by 2050. More recent calculations indicate that this increase could occur much earlier, perhaps within the next 10 years. In economic terms this might be viewed as encouraging news for the pharmaceutical industry. Increased drug use means increased sales. But many drugs will no longer be covered under current licence agreements and cheap generic competitive products may flood the market, especially from emerging economies. Yet despite these worrying developments, the 10 major

drug companies still managed to generate \$644 billion in global revenues in 2009!

The claims of the pro-pharmaceutical lobby concerning health benefits also merit close scrutiny. For example, in the USA the average expenditure on pharmaceuticals per person per year is £630 and average life expectancy is 78.37 years. However, in Ireland, Belgium, Austria, Spain, Denmark, Germany, Italy, Sweden, UK and the Netherlands, where life expectancies are longer, less than half of the USA figure is spent per person per year on medicines.

THE FATE OF PHARMACEUTICALS

In periods of economic turbulence it is not popular to place impediments in the way of rapid economic recovery. Nonetheless, in the past huge costs to society and the environment could have been avoided by heeding early warnings of potential threats – asbestos and climate change providing notable examples. With regard to the pharmaceutical industry, it is the fate of their products following use that is of growing concern.

When drugs enter the body they are metabolised or broken down into other compounds. Often a proportion of the pharmaceutical will pass through the body unchanged before being excreted. Drug-contaminated urine and faeces are then delivered via the drainage system to the sewage

works for treatment. Further breakdown may occur, but still a proportion of the original drug or its metabolites is discharged into river systems. Also, some of the drug may be retained in the solid phase of sewage which is then used as a fertilizer in agriculture. One might imagine that the concentrations of the pharmaceuticals in all of these wastes would be too small to detect – but they are not. Several hundred drugs can now be measured in water, sediment and biological samples taken from the environment, including antibiotics, antidepressants, analgesics and cancer chemotherapy agents. At present, concentrations are generally very low, but as we have seen earlier, pharmaceutical use is expected to rise rapidly in the coming years, driven by the needs of the ageing population. Already, both drinking water and vegetables have been found to contain low levels of drug residues. This is only part of the story. Pharmaceuticals are also used in very large quantities as veterinary medicines, especially in relation to animal husbandry. Here worries relate to antibiotics and antiparasitics used to treat livestock that then end up in soil and groundwater.

IMPLICATIONS FOR THE ENVIRONMENT AND HEALTH

Is there evidence that pharmaceuticals dispersed in the environment can cause problems? Undoubtedly yes. Many countries have reported that ethinyl oestradiol released from the contraceptive pill is responsible for the feminisation of male fish in rivers. On the Indian subcontinent, the anti-inflammatory drug, diclofenac, has killed tens of millions of vultures feeding on the carcasses of dead cattle. Ivermectin, previously used in fish farming

to kill salmon lice, had to be banned for that purpose because of its damaging environmental impacts. Another key concern from the widespread use of antibiotics is the emergence of antibiotic resistant strains of bacteria such as MRSA and *Clostridium difficile* (*C.diff*). But resistant bacteria are not restricted to medical settings. Recent studies show that MRSA is present along the Florida coast and can contaminate people of all ages using the beaches.

COURSES OF ACTION

Are these legitimate concerns or just the unwarranted fears of a few individuals? They are at least sufficiently worrying to provoke the Government's Advisory Committee on Hazardous Substances to set up a sub-committee earlier this year to investigate this issue in detail. The European Environment Agency also published a report in 2010 urging action. They concluded that the situation with regard to pharmaceuticals in the environment looks worse than a decade ago, that we should improve pharmaceutical waste management and that we need robust information to guide the public and policymakers. In its final ever report in March 2010, the Royal Commission on Environmental Pollution specifically highlighted the link between demographic change and the release of pharmaceuticals into the environment. Elsewhere, the Society of Environmental Toxicology and Chemistry (www.setac.org) which has over 5000 professional members in over 100 countries, takes the matter very seriously. In 2005, it established a pharmaceuticals advisory group and is currently conducting an exercise involving the international scientific community to identify 20 key priority questions that should be

addressed to inform us about how to deal with drugs discharged into natural ecosystems. Sensible courses of action might include incentivising the development of "greener" pharmaceuticals, which degrade rapidly after use to harmless residues, or to label drugs more effectively to identify those which need special waste treatment. Other innovative practices that the pharmaceutical industry might adopt could include forming stronger alliances with those engaged in preventative medicine and public health. It is neither desirable nor affordable to use pharmaceuticals to treat the rapidly rising number of cases of obesity and related diseases (diabetes, cardiovascular diseases, etc), nor the epidemic of psychiatric disorders (especially depression). There are now literally thousands of programmes around the UK intended to motivate people to spend time being physically active outdoors (eg "Green Gym", "Blue Gym", "Walking your way to Health") to help them avoid these conditions. Collaboration with the pharmaceutical industry might readily lead to combined approaches in which both increased outdoor activity, coupled with appropriate drug therapies, could result in a step change in the health of the population, and associated economic benefits all round.

SUMMARY AND CONCLUSIONS

Pharmaceuticals contribute immensely to the treatment and prevention of disease, and to the quality of our lives. The pharmaceutical industry deserves support and investment. However, the way it has operated in the past must change. More of the same simply won't do. With an ageing population in the affluent West,

use of medicines is increasing alarmingly. Similarly, in developing countries with a further 3 billion people to be added to the population by 2050, and the wider availability of low cost, generic products, the use of prescription and non-prescription products will also escalate. Urgent measures are required to plan for the disposal of the resulting pharmaceutical waste. The pharmaceutical industry as well as Government has responsibilities in this regard. The concept of economic externalities to which industrialists are so attached is no longer viable. There are no externalities. Someone has to pay to clean up water supplies and decontaminate land where pharmaceutical residues can be detected. Someone has to pay the additional health care costs resulting from the emergence of antibiotic resistant bacteria, and someone has to pay for the loss of ecosystem services that result from the unintended impact of pharmaceutical residues on wildlife. Responsible innovation by the pharmaceutical industries offers the best hope of tackling these issues. This will require establishing new partnerships between the pharmaceutical industries, the public health sector and those responsible for maintaining a sustainable environment.

