Gesunderhaltung und Präventivmedizin

Der Begriff der Vorbeugung verlangt zunächst nach einer Definition des Ereignisses oder des Zustandes, dem vorgebeugt werden soll. So ist es natürlich, dass selbst an einer der Gesunderhaltung gewidmeten Tagung zunächst der Arzt zum Zuge kommt. Die Präventivmedizin kann sich in angelsächsischen Ländern auf eine grosse Tradition stützen. Das Vereinigte Königreich verfügt wie wohl kaum ein anderes Land über Erfahrungen mit einer umfassenden präventivmedizinischen Versorgung, die im ersten – englischen – Beitrag zusammengefasst werden. Dass auch unser Land auf beträchtliche Erfolge der Präventivmedizin verweisen kann, kommt im Artikel eines Vorkämpfers der modernen Sozial- und Präventivmedizin in der Schweiz zum Ausdruck. Deutlich wird bei beiden Autoren, dass präventive Bemühungen – obwohl häufig Leistungen des einzelnen – nur auf einer epidemiologischen, populationsmedizinischen Basis erfolgreich verwirklicht und beurteilt werden können.

Maintien de la santé et médecine préventive

La notion de prévention exige en premier lieu une définition de l'événement ou de l'état qu'il convient de prévenir. De ce fait, il est tout naturel que lors de Journées consacrées au maintien de la santé, ce soit au médecin qu'il appartienne d'intervenir en premier. Dans les pays anglo-saxons, la médecine préventive peut s'appuyer sur une longue tradition. Plus que tout autre pays, le Royaume-Uni dispose d'expériences quant à une prise en charge complète en matière de médecine préventive, expériences résumées dans la première contribution – en langue anglaise. Le fait que notre pays peut, lui aussi, se prévaloir de succès notables en matière de médecine préventive trouve son expression dans un article d'un pionnier de la médecine sociale et préventive moderne en Suisse. Ces deux auteurs mettent en évidence le fait que les efforts en matière de prévention – bien qu'étant souvent basés sur des prestations individuelles – ne peuvent être réalisés avec succès et jugés que sur la base de connaissances épidémiologiques touchant l'ensemble d'une population.

Prevention – Everybody's Responsibility [1]

W. W. Holland [2] *and Angela Wainwright* [3]

Introduction

It has been said (quoting from the title of a recent United Kingdom government publication [9]) that Prevention and Health is everbody's business but nobody's responsibility. Of course this specifically refers to our health service structure in the UK but it may equally apply elsewhere.

It might be more accurate to say, however, that far from being nobody's responsibility it is in fact everybody's responsibility. What is required for effective prevention is a stimulus from those with statutory responsibility for applying preventive medicine and for imparting knowledge of preventive methods to encourage all individuals to take responsibility for their own health. This attitude is particularly relevant in the context of the most common causes of death and disability in Western societies i.e. coronary heart disease, cancer, stroke and chronic respiratory disease. It is less relevant in the context of infectious disease but even so, as has been illustrated by an increase in the incidence of whooping cough following the fear of vaccination damage, the onus is on individuals to ensure that appropriate preventive measures are taken if they are available. The individual responsibility is less relevant in preventing illness caused by intra-uterine or genetic factors and here the health and social services are responsible for provision of appropriate monitoring services, family planning, abortions, and antenatal care. But there is still some individual responsibility involved, for example, in actually keeping antenatal appointments, and perhaps avoiding pregnancy where conditions for bringing up a child are unsuitable and when the risk of congenital malformation is high.

I have been asked to cover the entire disease spectrum which is a somewhat daunting prospect. My own experience lies in the field of non-communicable disease but the importance of infectious disease must not be forgotten. Infectious disease is the only major field in which preventive measures *have* met with success in this century. We still have no effective methods to prevent the onset of coronary heart disease, cancer and chronic respiratory disease or the mortality and chronic disability resulting from traffic accidents. We are as yet unable to prevent people from taking up smoking,

[1] Keynote address given at the Forum Davos 78 meeting: Limits of Medicine III–Prevention and its Possibilities

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from becoming obese through inappropriate diet, attempts to encourage regular exercise are unsuccessful and in many countries the wearing of seat belts is not obligatory.

All these measures bring to mind the question of individual freedom: many people would maintain that the individual has the right to smoke cigarettes, to eat or drink too much but added to this we must question his right to create unnecessary suffering and expense for others whether it be his family and friends or the health and social services.

Infectious diseases

To return to the subject of infectious disease it is of course incorrect to maintain that conquering the major infectious diseases, which were largely responsible for mortality in the past, has been entirely due to preventive medicine measures in the strict sense. Far more important have been improved living and working conditions, including housing, water supplies and sanitation, and better availability, preparation and storage of food. Although these factors have been largely responsible for the decline in mortality from these diseases isolation of the causative agent followed by development of live or attenuated vaccines has, in some cases, been responsible for continuing and perhaps accelerating the decline in mortality and perhaps almost abolishing some diseases: for example, there were only 2 notifications for diphtheria, 15 for tetanus and 15 for polio in the UK in 1976.

The success of prevention of many infectious diseases has unfortunately led many to decide against vaccination; this is of course coupled with the fear of vaccine damage particularly in the case of whooping cough. This reduction in vaccination acceptance rates as illustrated in *Table 1* will of course increase the risk of further disease outbreaks. Polio, for example, is still present in some countries and the virus may be imported inadvertently. It is now recommended that UK travellers abroad should ensure that they are adequately protected against polio rather than smallpox which is now almost extinct thanks to the massive campaign sponsored by the World Health Organization. Memory of the horrifying effect of polio is obviously insufficient–one child in three in the UK is now *not* being taken for vaccination [9].

The fear of vaccine damage from whooping cough has had a profound effect on incidence of the disease. The provisional figure for the number of notified cases in the UK is 17,334 compared with 3907 for 1976.

Despite the widely held belief of doctors (and mothers) in the importance of preventing childhood measles the UK acceptance rate for measles vaccination was only 45 % for children born in 1974 and vaccinated by the end of 1976 *(Table 1)*. In 1976 there were 55,498 notified cases compared with a provisional figure of 172,799 for 1977.

Mortality from certain infectious diseases has declined irrespective of active preventive measures. An example is scarlet fever, which at the turn of the century had a case fatality of 3–4 % but in 1973 only 3 deaths occurred in 13,000 cases. A fall in mortality from whooping cough and measles also took place early this century before the introduction of vaccine, or of sulphonamide drugs for treatment of complications. These declines in death rates were probably partly attributable to better resistance by children as a result of improved living conditions, as well as to decreasing virulence of the causative agent: the latter is particularly thought to apply to scarlet fever.

Tuberculosis is a good example of a disease which has declined substantially for a number of reasons. Early this century improved nutrition and living conditions especially reduced overcrowding, personal hygiene

TABLE 1

Acceptance rates for vaccination against childhood infectious diseases in England

Source: DHSS Medicines Division, 1978.

	% of children born in 1968 vaccinated by end of 1970	% of children born in 1971 vaccinated by end of 1973	% of children born in 1973 vaccinated by end of 1975	% of children born in 1974 vaccinated by end of 1976
Diphtheria	80	81	75	75
Whooping Cough	79	79	61	39
Tetanus	81	81	75	75
Polio	79	80	75	75
Measles	34	54	47	47

and sanatorium treatment all played a major part in reduction in mortality and numbers of notified cases. The introduction of mass radiography, BCG vaccination and antibiotic treatment between the 1930s and the early 1950s effectively accelerated the decline of the disease. Total eradication of the disease in Western Countries is complicated by the incidence among immigrants. A recent study in the UK has shown that although 5 % of the population are immigrants they account for 32 % of TB cases [23].

The Joint Tuberculosis Committee recommends that accurate information on all immigrants should be sent to the medical officer for environmental health at their destination in order to follow-up those who are not x-rayed at Heathrow Airport, London. Those that are x-rayed following positive reaction to tuberculin testing should be BCG vaccinated and encouraged to report symptoms and be x-rayed in future. Strong positive reactors should of course receive chemoprophylaxis. Implementation of such actions particularly those involving environmental health officers (and school health services) are vital to continue the steady decline of the disease in Western societies. Others who have frequent contact with immigrants, such as teachers and nurses, must also be encouraged to have regular checks.

Although serious illness and mortality as a result of infectious disease is now relatively infrequent in Western society it is important not to lose sight of possibilities for further preventing both suffering and sickness absence. The condition which comes instantly to mind in relation to both is influenza. Because the viral agent causing 'flu is constantly changing it has proved impossible to produce a vaccine which is effective for all strains of the disease. Excess deaths among the elderly amount to several thousand every year and sickness absence because of 'flu causes a considerable loss of valuable working time. Hence vaccination for a condition that is non-fatal such as 'flu should be directed at those who will suffer most and those working in essential services. The cost of preventing the disease, if effective measures were available, would have to be contrasted with the actual cost of health services and loss of productive work as a result of catching the disease.

Rubella in the first month of pregnancy is associated with a 50 % risk of congenital malformation with the risk decreasing to 10 % after 8–12 weeks. Active immunisation of 10–14 year girls is now the recommended preventive measure for congenital rubella syndrome but in England and Wales only 70–75 % of girls are vaccinated by the age of 14. In England two regional surveillance centres have been set up to assess the long-term effects of rubella vaccination. Several years will have to elapse before the value of vaccination in 11-year-old girls can be proven as a preventive measure. Lechat [27] has recently reviewed the methods used to assess the danger of rubella in pregnancy, measurement of the risk to the fetus and the preventive measures available.

The infective agents that cause various gastrointestinal symptoms are of particular interest as an up-to-date example of how surveillance of a disease and isolation of causative agents led to development of preventive methods. The Communicable Disease Surveillance Unit is largely responsible for such surveillance in the UK. The Unit receives weekly reports of isolations from laboratories throughout the country and in the case of an outbreak of a previously unrecognised condition is able to provide the epidemiological expertise to attempt to trace the infective process of an organism to its source with the aim of preventing further infections or future outbreaks. By scanning of routinely collected data for, say, outbreaks of salmonella poisoning any changes can be recognised and studies set up to search for causes. For example, such surveillance revealed that outbreaks of salmonella poisoning from poultry in the UK was a result of infected imported feedstuffs. In such instances the preventive measure must come from the veterinary authorities, i.e. in better testing of imported feedstuffs and in control of poultry flock inbreeding.

Among the serious gastrointestinal diseases the incidence of typhoid in the UK has doubled in the last few years largely because of carriers coming into the country. Apart from enforcing all travellers from countries where the disease is common to go into quarantine, it is impossible to prevent the disease entering the country but prompt isolation on confirmation of diagnosis should prevent it spreading. Typhoid is an excellent example of a current preventive health problem in developed countries which arises because of increased air travel: approximately 22 million people pass through London's Heathrow Airport every year. Perhaps the change in dangers from disease carried in from other countries is particularly notable in the UK because of its previous isolation from the rest of Europe–only the Channel and strict control of animal importation prevents rabies being introduced into the country.

Gastrointestinal diseases in most Westernized countries are most serious for babies and in the UK 400 deaths per year occur as a result of such infections in the under 2-year-olds. It has been found that gastrointestinal infections are rare in babies who are exclusively breast fed and as a result this is heralded as the most effective preventive measure. Every effort should be made to provide support and encouragement for mothers who are breast feeding. Careful attention to control of infection spread in hospitals and of course improvements in living conditions are also vital preventive measures.

In the last few years a number of "new" organisms have been isolated and related to specific diseases. Many of these "new" isolates have probably existed for a considerable time but they only come to light as causative disease agents when culture techniques enable their presence to be linked with particular symptoms. The newly named rotaviruses which are probably airborne and have been found to cause gastroen-

teritis, particularly in young babies, are one example and the various campylobacter, are another; the latter have mainly been isolated in animals and poultry.
Legionnaires' disease is a current example of a newly recognised disease [51]. Knowledge of this severe form of localized pneumonia which is resistant to most antibiotics and may be fatal for patients already compromised in some way only extends as far as isolation of the responsible agent; as yet its source is unknown [15, 33]. Alexander Langmuir, retired chief of the Center for Disease Control in the US, feels that this disease is one that may spread worldwide to become "a bigger problem than we now realise".
Reduction of incidence of communicable disease rests partly with those responsible for collection of data and surveillance of changes in frequency. It also rests with those responsible for educating the public themselves to heed the warnings of increased disease incidence following reduction in acceptance of vaccination.
It should also be realised that outbreaks of a disease may not be important in terms of prevention of morbidity and mortality. What is important is the overall frequency of a disease in a population. Outbreaks of, say, a gastrointestinal infection can often be traced to a simple lapse in hygiene precautions which is unrelated to the situation in the general population.

Non-Communicable Diseases

In the UK diseases of the circulatory system account for over 30 % of all male deaths in the 25–44 age group and 50 % of all male deaths in the 45–64 year age group. All cancers are responsible for 20 % of all male deaths in the 25–44 age group and 28 % of male deaths in the 45–64 year age group. Respiratory disease, the other major culprit accounts for nearly 10 % of deaths in both men and women aged 45–64. *Table 2* summarises the main causes of death and disability.
I have specifically pointed out these predominant causes of deaths for the middle-aged population because it is these and the related morbidity which could be regarded as premature or excess and it is these which should be amenable to preventive action. Unfortunately however, effective methods of prevention have still to be found.
Although there is some overlap of factors associated with the onset of these diseases and hence related preventive action, it is worth considering the three "blights of middle age" separately.

Table 2

Causes of death

0 - 44 years	45 years and over
1. External causes (accidents)	1. Circulatory (mainly ischaemic heart disease and stroke)
2. Malignancy	2. Malignancy
3. Congenital anomalies	3. Respiratory
4. Circulatory (mainly ischaemic heart disease)	
5. Infection	

Causes of disability

0 - 44 years	45 years and over
1. Psychosocial	1. Circulatory (mainly ischaemic heart disease and stroke)
2. Respiratory	2. Musculo-skeletal (including arthritis)
3. Central nervous system	3. Eye and ear
4. Musculo-skeletal (including arthritis)	4. Respiratory
5. External causes	5. External causes
6. Dental caries	

Coronary Heart Disease

The factors associated with the development of coronary heart disease are well-known i.e. hypertension (which may be related to obesity), smoking, lack of regular exercise, family history of coronary heart disease, diabetes and possibly serum cholesterol level. What is not known is to what extent these factors really do predispose an individual to develop coronary heart disease and whether removal of a particular factor reduces the risk. Assessing the risk from a particular factor is further complicated by the interrelationships between the various factors.
A joint study is taking place in Edinburgh and Stockholm [31] to try to determine why the mortality rate from coronary heart disease in men aged 40 is three times higher in the former. Various clinical measurements, questionnaires and electro-cardiographic tests were applied to a random sample of 40-year-old men actually born in the cities. A number of notable differences were found: Edinburgh men were shorter and fatter; had higher blood pressure; smoked more cigarettes (although the number of smokers in the two groups was similar); drank more alcohol; and had higher levels of serum triglycerides.
The emphasis placed on serum cholesterol levels seems inappropriate from these study results (compared with other studies–particularly in the US) but Logan and colleagues are paying greater attention to the metabolic pathways which may lead to development of coronary heart disease.
There may be some change of emphasis occurring away from the now traditional risk factors of cigarette smoking and high blood pressure towards genetic or metabolic factors but these factors cannot be dissociated from each other and the importance of development of risk factors in childhood for which there is increasing evidence cannot be understated. For so many people their life style with regard to eating and drinking habits, smoking and exercise are established before they are 20 and by which time a considerable amount of damage may already have been done. Several studies are underway to determine the preva-

lence of certain risk factors and to develop methods to reduce them.

Research in two cohorts of schoolchildren in the UK has established that nearly 5 % of schoolchildren aged 11–12½ years are already smoking with a higher percentage among boys, many more (over 30 %) have experimented with cigarettes by this age [3]. Factors influencing children's smoking include parents' and siblings' smoking, peer group pressure, and a desire to appear "grown-up" [4]. *Table 3* aligns the various factors influencing children's smoking with possible methods of intervention.

Research is continuing in the UK Derbyshire cohort of 6000 children to establish whether a specific health education programme aimed at providing children with information about risk of smoking is effective in encouraging them to give up smoking before the habit is established. To avoid introducing the effect of different smoking habits between schools, the controls will be children two years senior to the study children.

A study in the US [56] has shown that 40 % of a sample of 3000 11–14 year olds had one or more risk factors for CHD, the most common of which were raised serum cholesterol (17 % had levels over 180 mg per cent), obesity (12 %) and cigarette smoking (10 %).

The US Know Your Body programme developed by the American Health Foundation is an example of a screening programme followed by intervention of those at high risk in the form of health education. The results of screening which includes a health knowledge and a health habits questionnaire are presented to children on an individual level in the form of a "Health Passport". Success of the programme in modifying risk factors will be assessed by repeat screening every year.

A further study of relevance in the context of risk factor assessment is the UK National Study of Health and Growth [22, 41]. In this study about 10,500 children aged 5–11 years are being measured and weighed to determine growth patterns in this age group and the influence of social and environmental factors on growth. As an adjunct to the main study it is planned to assess the affect of dietary advice in preventing or reducing obesity and possibly lowering blood pressure.

Work is going on in the UK to determine whether it is possible to identify children who are at greater risk of developing high blood pressure because they have a blood pressure level consistently above that of their peers of the same age over a period of three years. The relationships between children's blood pressures and those of their parents and siblings are also being studied and some evidence of interfamilial clustering has been found [19].

Risk factor detection and intervention in the middle-aged is of less recent origin than attempts at tackling early risk factors in children but as yet most attempts at reduction of risk factors inherent in the Western life style have been unsuccessful. There is, however, some evidence of a decline in mortality from coronary heart disease.

Walker (1977) has documented the steady decline in the mortality rates from ischaemic heart disease in the US between 1963 and 1975. In the UK there is recent evidence in men of a similar stabilisation and slight decline taking place from 1973 onwards [13]. This decline appears to be taking place at the same time as the decline in cigarette consumption by men and in a general decline in the household use of animal fats and refined sugar and an increase in vegetable fats.

Blood Pressure Control in Adults

The Veterans Administrative Cooperative Study Group [52, 53] have proven the effectiveness of antihypertensive agents in treating hypertension (both

Table 3

Factors influencing children's smoking		Intervention for reduction of children's smoking
Personal	Academic ability Truancy Rebelliousness (anticipation of adulthood) Health attitudes	Inter-related and depend on type of school - all are difficult to alter Knowledge of smoking related diseases both long- and short-term
Environmental	Type of school Societal attitudes	Teacher and peer group attitudes Conflict between advertising and government-sponsored health education
Family and friends (Social)	Parents	Affected by societal attitudes Special programmes e.g. health education in pregnancy.
	Siblings	Peer group influence all affected by societal attitudes and other factors

severe and moderate) and reducing mortality from circulatory diseases. However, the population in this study were easy to follow-up and were a compliant selected group.
A recent long-term controlled trial of multiphasic screening of the middle-aged showed no benefit from screening in terms of morbidity and mortality over a nine-year follow-up period [48]. Although some hypertensives were newly diagnosed little difference was found in population blood pressures among screened or control groups over a five-year follow-up period [11].
This may have been because general practitioners decided against antihypertensive treatment or because of non-compliance with treatment. Most of the hypertensives detected in the screening clinic were in fact aware of their condition. These results indicate that since most people in the UK visit their general practitioner at least once in five years, case-finding following routine blood pressure checks at each visit may be as effective for detecting hypertension as screening on a population basis.
There is little doubt about the cost effectiveness of blood pressure control as a method of preventing cardiovascular events but what is questioned is the ability of doctors to persuade people to comply with long-term treatment.
A study in the United States has shown how a system of screening, referral and then follow-up of screening might be a cost-effective method of reducing hypertension [14] but what is ignored in the cost-effectiveness calculations is the fact that labelling a person as being hypertensive may well lead to greater absenteeism from work. In a screening study of 6000 Canadian steelworkers, Sackett et al. [43] found that more absenteeism from work occurs in hypertensives who are aware of their condition and who have been started on antihypertensive treatment. Such evidence should be borne in mind when considering cost effectiveness of such screening.

These screening studies provide useful illustrations of the criteria which should be applied to any screening programme laid down by Wilson and Jungner in 1968 [55]. These are as follows:
(1) The condition sought should be an important health problem.
(2) There should be an accepted treatment for patients with recognized disease.
(3) Facilities for diagnosis and treatment should be available.
(4) There should be a recognizable latent or early symptomatic stage.
(5) There should be a suitable test or examination.
(6) The test should be acceptable to the population.
(7) The natural history of the condition, including development from latent to declared disease, should be adequately understood.
(8) There should be an agreed policy on whom to treat as patients.
(9) The cost of case-finding (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole.
(10) Case-finding should be a continuing process and not a "once and for all" project.
In a recent article Holland [18] emphasised that the only conditions which satisfy these strict criteria for whole population screening are congenital dislocation of the hip and phenylketonuria in infancy and hearing and visual defects. It is also recognised that rhesus factors and bacteriuria in pregnancy, although they may not satisfy all criteria are worth screening for and it is likely that anencephaly and spina bifida may also comply with these criteria. Selective screening in certain groups may be justified for a number of conditions [17].

Malignant Neoplasms

Lung Cancer

Much of what has been said about smoking and cardiovascular disease can be applied to prevention of lung cancer but several specific points related to adult smoking are relevant. Although general population based anti-smoking campaigns against smoking, higher prices and restrictions on smoking in public places have only a limited effect on the total amount smoked, what is more likely to be effective in reducing mortality is personal counselling sessions relating smoking habits to symptoms. Holland and Elliott [20] have found some effect in children but there is as yet no proof of the effectiveness of counselling in adults. In the UK a decrease in smoking among the upper social classes has been replaced by an increase in lower social classes and this change can be related to the changed social class distribution of mortality from coronary heart disease and lung cancer [35]. The increase in these conditions in lower social classes may be attributable to the ineffectiveness of health education which too often is designed and applied by people of middle class background and education who are unable to impart health knowledge in a comprehensible way to people from less privileged backgrounds.
The subject of smoking of course creates conflict when governments are raising enormous tax revenues from tobacco on the one hand but providing limited resources for anti-smoking education on the other. If however, governments could be persuaded to make it prohibitive to smoke–thus reducing tax revenues savings may be made in terms of health service costs. However, the reverse arguments can also be applied–e.g. if people could be prevented from dying prematurely from smoking-related diseases they would increase the need for health service expenditure in later life when disabled and senile. The question of individual freedom of choice also applies here.
Breast Cancer kills 11,000 women every year in England and Wales accounting for 13 % of female deaths between the ages of 30 and 60. A randomized controlled trial in the Health Insurance Plan in New York

[44,45] showed that of women who were screened for breast cancer and who therefore received earlier treatment less had axillary node metastases thus indicating a better prognosis. Despite this positive result and those from other studies, poor response rates to screening and high costs may reduce the apparent advantages of breast cancer screening.

In a study in England and Wales only 38 % of women, invited by their GP, attended for screening [2] although in a Swedish study [25] 81 % responded. The screening procedures currently available present the additional problem of high false positive rates which mean that 80 % of women biopsied have benign disease–a high cost in terms of mental agony as well as health care resources. It is generally thought that mass screening for breast cancer by mammography is prohibitive in cost and manpower terms, especially since effectiveness depends on regular repeat screening. Palpation used alone has yet to be proven to be an accurate screening method and again there are problems in persuading women to self-palpate regularly. The development of methods to accurately diagnose cancers after positive screening tests without the need for biopsy would be welcome (together with a reduction in the false positive rate of screening) but there remains the problem of persuading those at highest risk to attend for screening.

Cervical Cancer

It seems that the question of whether cervical screening does reduce mortality from cervical cancer is difficult to answer. The fall in mortality from cervical cancer was occurring before the introduction of cervical smears and it has continued to decline at the same rate with little difference between areas where a high proportion of women are screened and where a low proportion are screened [7]. Knox [24] has estimated that the reduction in mortality as a result of screening may be only about 10 %. Although a number of studies [38] have shown the effectiveness of cervical screening a randomised controlled trial has never been performed and nowadays ethical considerations and the weight of public opinion would prevent such a trial being set up.

Even if the considerable controversy is ignored there remains the problem, as with breast cancer screening, of persuading those who are at higher risk of the disease to attend for annual screening.

Occupational Cancers

Successful prevention of cancers induced by occupational exposure to carcinogens is largely the responsibility of the employer but this responsibility may have to be enforced by legislative measures.

The responsibility of the individual must not be ignored, however. Individuals must understand and be willing to comply with safety measures, for example, in wearing protective clothing and equipment and taking suitable hygiene precautions.

Because most cancers take considerable time to become apparent, it is vital that careful records are kept of exposure of individuals to hazards. Only in this way can the damaging concentrations of hazardous substances be assessed and future levels reduced. Unfortunately deaths and considerable suffering will occur before a hazard is recognised, unless dangers can be promptly recognised and acted upon. Regular screening of individuals who are known to be exposed to hazardous substances may serve as a secondary preventive measure whereby the early stages of disease are detected before the disease course is irreversible. This is also relevant in relation to, for example, asbestosis, byssinosis, exposure to noise and vibration and many of the conditions caused by industrial poisons, as well as carcinomas.

Chronic Bronchitis

This is the third most common non-communicable ailment which, in the UK, causes 30,000 deaths every year and is responsible for illness in one million people. Not only are respiratory diseases a major cause, as well as a contributory cause of death in old age but they also cause ten per cent of all male deaths in middle-age. Bronchitis has long been recognised as the "English disease" which was once very common in areas of high air pollution and inclement weather conditions. Nowadays, considerable improvements in pollution levels as a result of Clean Air Legislation of 1956 and 1968 has led to smoking becoming the most important cause of bronchitis [39, 40]. Acute respiratory illness in children is now recognised as one of the important factors related to impaired ventilatory function and development of chronic respiratory problems in later life [28]. It is also worth noting that whereas many infections in early life are difficult to avoid, passive inhalation of smoke from parent's smoking which has been shown to be related to respiratory illness in the first year of life and reduced ventilatory function [8, 29] can be avoided if successful anti-smoking measures could be found–especially for parents of young children.

Melia et al. [34] have found an association between gas cooking and the prevalence of reported bronchitis and other respiratory symptoms in children; it is thought this might be due to higher concentrations of nitrogen dioxides in the atmosphere from the combustion of cooking gas and further research is underway to elucidate this relationship.

Chronic Disability in the Elderly

Besides the three common non-communicable diseases already discussed, several typical ailments of old age are amenable to tertiary prevention. Unfortunately too many of these disorders are simply disregarded, both by medical personnel and patients, as part of the natural process of ageing. In fact many such conditions can be improved by appropriate treatment and sensible consideration of the social conditions which may exacerbate disease and disability. Anderson [1] has

drawn attention to the fact that the elderly may not display typical symptom patterns and because a number of conditions probably co-exist, screening of the elderly must be a process which covers physical, mental and social wellbeing. Inevitably this will involve the joint participation of a variety of health personnel and the co-operation of families. In many Western countries the problems of ageing are in part attributable to the changeover from the "extended family" to the "nuclear familiy".

Any approach to problems of the elderly must, of course, depend on social attitudes, population density and the structure of the health and social services.

Prevention in Pregnancy and the Early Years of Life

Although the use of screening techniques are accepted as essential during pregnancy, even to the extent that in some countries financial benefits are withheld unless regular attendance at antenatal clinics takes place, only some of the techniques used have been proved to be truly effective. These include routine blood grouping for detection of rhesus incompatibility followed by administration of anti-D globulin, detection of bacteriuria to prevent development of acute pyelonephritis and the prediction of neural tube defects in the fetus by measurement of plasma and (the more controversial) amniotic alpha fetoprotein; the plasma measurement is simple and safe but not as reliable as amniocentesis which creates some risk of spontaneous abortion. In a recent study of 102 pregnancies with raised serum alpha fetoprotein who received amniocentesis [16] there were 15 terminations which neural tube defects (spina bifida and anencephaly) and spontaneous abortions of 3 normal fetuses and 1 abnormal. Two of the normal fetuses aborted because of placental puncturing. From estimates of the number of babies with neural tube defects and the number of women with raised serum alpha fetoprotein during pregnancy, it was calculated that only 1 in 6 women who have amniocentesis would be carrying fetuses with defective neural tubes.

Since this study found that fetal wastage can result from placental puncture the authors recommended that provision of ultrasound techniques should be increased for use in conjunction with amniocentesis.

Because of inherent dangers in amniocentesis itself, its use should be restricted to women at high risk and even with this restriction, far more research into cost effectiveness is required.

Screening for phenylketonuria (PKU) in neonates, which occurs once in every 10,000 births, and subsequent prevention of mental subnormality by introduction of a low phenylalanine diet in identified cases [47] is one of the few disorders for which whole population screening appears to be justified. However, an earlier study [32] found that not all children who have PKU have any clinical manifestations of it and the effectiveness of lowering serum phenylalanine in preventing mental retardation may not be proven [5]. Thus neither the natural history of the disease or the effectiveness of treatment were established before the test was introduced and its use now follows retrospective evaluation [50]. Bearing in mind the experience of PKU techniques could be developed for use in other more common metabolic disorders such as cystic fibrosis which occurs about once in every 2000 births. Detection of certain endocrine disorders such as neonatal hypothyroidism seems to be a more hopeful prospect, however. Dussault et al. [12] have estimated the incidence at one in every 7000 births and performed a pilot study of the effectiveness of screening. In this case prompt treatment of cases detected would prevent development of irreversible mental and physical retardation.

Apart from the obvious causes of death in early life as a result of severe congenital malformations, birth hazards, defective intrauterine growth and respiratory disease among the 16 deaths per 1000 live births that occur in England and Wales per annum, are a considerable proportion of unexplained deaths.

A recent retrospective case-control study in the London borough of Lambeth (Palmer et al.–personal communication–1978[1]) has shown an association between "cot" deaths and maternal age, parity, birthweight and number of antenatal visits. This study followed some work in Sheffield which suggested that parental attitudes to use of health services and responsiveness to signs of illness in children are associated with infant deaths [36].

Carpenter et al. [6], in Sheffield, have devised an "at risk scoring system using social, demographic, obstetric and postnatal details but preliminary results of a multicentre survey suggest that the system would only predict 49 % of the cases of sudden infant death, while 27 % of controls would be said to be "at risk" [37]. Oakley has reminded researchers of the need to establish the importance of local risk factors in such a scoring system. Other aspects, such as the resources required to maintain adequate surveillance of "at risk" babies and the right of medical services to interfere with personal freedom, are relevant here.

Developmental screening is the natural step from antenatal, obstetric and postnatal care but its value has been much criticised, predominantly because of the difficulties in performing clinical examinations in children [21]. Observer or examiner variations can determine whether a child is labelled normal or abnormal. For example, developmental delay may mean any one or a combination of a number of things: for example, the earliest manifestations of mental retardation or cerebral palsy, adverse social circumstance or emotional disturbance. Tests for developmental delay, congenital dislocation of the hip and heart disease are all in common use and yet none really satisfies all the criteria for a screening technique. For example, in screening for dislocation of the hip, which effects almost one per 1000 live births, it is recognised that lack

[1] Palmer, S. R., Wiggins, R. D. & Bewley, B. R., "Possibly avoidable" infant deaths in Lambeth. Paper in preparation.

of experience and screening in the first five days of life can result in missed cases and some false positives as well. Holt [21] has suggested that more research into establishing the risk factors associated with the condition should be performed followed by concentration on those at higher risk.
This approach is perhaps a good example of the lack of agreement between those who advocate whole population screening, even before proper evaluation of a screening technique has taken place, and the hazards of low sensitivity and specificity in a screening test have been realised and those who are more cautious. It also illustrates how, although screening techniques are available for many disorders, they still require unprejudiced evaluation (as may the ensuing treatments); the lack of adequate trained staff is also a major problem in advocating such preventive measures.

Dental Health

Fluoridation of water supplies and good dental hygiene can contribute to reduction in suffering and the cost of treatment of dental caries. Some deaths also result from dental disease, for example, from anaesthesia and bacterial endocarditis. The evidence from studies in a number of countries has confirmed that at best dental caries could be reduced by half if the water supply contained 1 mg/litre of fluoride [42] but the present situation in the UK is that under 10 % of the population receive fluoridated water. This compares unfavourably with the situation in the US, where the figure is 50 % and in Holland where it is 45 %. Despite the horrifying figures for the extent of damage from dental decay–97 % of children under the age of 15 have some caries and the cost of dental disease amounted to £ 140 million in 1975–the Report of the Royal College of Physicians [42] which recommends addition of fluoride to water supplies has met with limited success.
In reply to a rather vociferous minority in a number of areas which has successfully prevented or held up this measure to improve dental health, it could be argued that a preventive measure such as air pollution reduction by means of Clean Air legislation which is, in effect, taking a harmful substance out of the environment, can be equated with the addition of a substance which will also have benefit in reducing morbidity. It can also be argued that a number of substances are *already* added to water. Unfortunately, the minority preventing the addition of fluoride to water supplies is perhaps unnaturally preoccupied with the notion of being compelled to take a "medicament".
In 1969 WHO made the following statement:

"To recommend Member States to examine the possibility of introducing and, where practicable, to introduce fluoridation of those community water supplies where the fluoride intake from water and other sources for the given population is below optimal levels, as a proven public health measure; and where fluoridation of community water supplies is not practicable, to study other methods of using fluorides for the protection of dental health' [58].
But despite reaffirmation of this resolution in 1975, a large number of countries have yet to implement the recommendation.
Recent research is coming up with a further alternative for the improvement of dental health–immunisation [30]. However, it is unlikely that such a major public health measure could be introduced on a population basis within the near future and it is also likely to be prohibitive in terms of cost compared to the relatively cheap procedure of water supply fluoridation. There is of course the alternative of persuading people to reduce the sugar content in the diet but undoubtedly most children (and many adults) would prefer twice yearly trips to the dentist to a life without sweets and cakes. Here the subject of social attitudes towards behaviour is relevant. If sweet-eating could become socially unacceptable, considerable reductions in morbidity from dental caries, and other diseases, would result.

Accidents

Again figures from the UK illustrate a severe problem for Western countries. Accidents contribute to one quarter of all deaths in the 1–4 year age group and most of these occur in the home. In later childhood (age 5–14) they cause 45 % of male and 30 % of female deaths usually involving motor vehicles and in young adulthood the number of deaths attributable to accidents is even higher (65 % of male and 43 % of female deaths aged 15–24). This distribution of accidental deaths i.e. high in the 1–4 and 15–44 year age groups also applies in 21 European countries. In Denmark and Holland almost all deaths in the 15–24 year age group are caused by traffic accidents [59].
In later life accidental deaths are still common but as a major cause are replaced by coronary heart disease, cancer and stroke. In attempting to prevent childhood accidents in the home the emphasis on parental care cannot ever be withdrawn but even with continuous vigilance, there will always be danger situations that cannot be avoided. Greater attention should be paid to safety features, including fire protection, by manufacturers of electrical goods, toys, drug containers, furniture, building materials and fabrics for children's wear. In the UK, it is shortly to become compulsory for all medicinal products to be labelled "keep out of the reach of children" [10].
A recent report on home accidents in the UK follows a new system whereby all home accidents which result in a visit to a hospital casualty department are reported to social workers who then visit the children's homes. Such a system shows how something can be done to prevent further accidents–advice given by a social worker will perhaps reinforce the feelings of guilt often felt by the parent.
Road accidents are responsible for 10 million injuries and 250,000 deaths every year throughout the world, a significant proportion of which occur in Europe [60].

Epidemiological analysis of causes of road accidents are complicated by lack of standardisation of the definition of a traffic fatality which, depending on the country, may either be at the scene of the accident or anything up to 30 days after it.

A variety of preventive measures notably seat belt legislation, speed restrictions, improved vehicle design, and the breathalyser, have been introduced. It is now compulsory to wear seat belts in a number of European countries and Australia, but despite the drop in road accident fatalities in these countries, there has been a reluctance to introduce legislation in the UK amid cries of "infringing the freedom of the individual" but we should question what sort of freedom it is that allows you to suffer the pain and disability or death following a serious head injury and inflict anguish and expense on relations and huge expense in terms of health and social services and loss of useful work to the community. It has been estimated that about 14,000 fatal and serious injuries could be averted every year if all drivers and front seat passengers wore seat belts at all times.

Enormous improvements have been made in terms of vehicle design but unfortunately safety precautions may be less stringent in the manufacture of economy cars. Undoubtedly technological improvement in vehicle design must aim at reducing the cost of incorporating such features as safer windscreens and tyres, collapsible steering wheels, padded fascia and, particularly where it is not compulsory to wear them, seat belts that are simple and quick to operate.

Introduction of the breathalyser in 1967 in the UK led initially to a fall in the number of serious accidents but since then the proportion of casualties occurring in "the drinking hours" has risen to the level at which it stood before the legislation was introduced. Educational methods of accident prevention can be extended from the obvious methods of persuasion through advertisement about the hazards of alcohol, drugs and fatigue to the actions of insurance companies in charging higher premiums for drivers who appear to be a "high risk".

Alcoholism

Excess alcohol intake whether it be manifest as alcoholism which carries a high risk of premature deaths from liver cirrhosis, certain upper respiratory tract cancers, accidents, mental illness and family conflict or at a less serious level, that of problem drinking which may result in family and social conflict and perhaps lead to total dependence is a problem which is estimated to affect half a million people in England and Wales. Because the proportion of heavy consumers is related to the average level of consumption this gives added weight to a recommendation to the UK government that the price of alcohol should not be allowed to fall in real terms relative to prices or incomes: in fact in the UK between 1970 and 1976 the relative cost of alcohol has fallen [10].

Other primary preventive measures include education of children and teenagers about the adverse affects of heavy drinking, various restrictions on the period in which alcohol can be sold and control on the media both by discouraging advertising which "glamourises" particular alcoholic drinks and increasing public awareness of the dangers of excess alcohol intake and of the symptoms of alcoholism and the treatment agencies available [10].

As with so many preventive measures the question that arises in so many people's mind is that of freedom of the individual and again the reply can be framed in terms of health and social service costs, reduction in family violence, increase in productive work for the community and a decrease in the morbidity and mortality of both drivers and others involved from accidents caused by drunken driving.

Drug Misuse

Given that in most Western countries the use of heroin and other opiates is illegal, it would appear that enforcement of existing legislation is the most important preventive measure but misuse of drugs extends much further to such things as amphetamines, barbiturates, tranquilisers and sleeping pills. Thus the figures for registered narcotics in any country only reveal part of the problem and the lack of reliable information on the extent of drug misuse hinders any attempt at effective prevention. Having said this there is still scope for health education both in educational institutions and through the media aimed particularly at that most vulnerable age group–the school-leaver who is moving into higher education away from home where the experience of readjustment may be traumatic and the environment is one in which drugs can be obtained more easily. The primary health care team as well as teachers have an important role to play in counselling and helping young people to overcome their problems without resorting to drugs. A climate in which drugs experimentation is regarded as stupid needs to be fostered.

Although many people feel that since cannabis is responsible for relatively little morbidity and mortality compared to tobacco and alcohol it should be legalised, there is some evidence of deleterious effects, for example, on reaction speed when driving and there is also a lack of evidence about the long-term effects of high cannabis intake. Because cannabis is illegal in many countries it would be impossible to carry out the type of intensive long-term research which has enabled elucidation of the effects of smoking.

Conclusion

I have attempted to give some idea of the enormous scope for preventive medicine in Western society today, but a number of general points present themselves as indicators for futher discussion. I should not really attempt to give what might be termed "priorities" for prevention because every society has different values and varied disease problems which may place

Table 4

Priorities for prevention

	Condition	Primary	Secondary	Tertiary	Research
Death	Malignancy	Stop smoking		Rehabilitation	Aetiology
	Congenital anomalies	Avoid teratogens Genetic counselling	Prenatal diagnosis	Rehabilitation	Aetiology Prenatal diagnosis
	Infection	Immunisation Improve social conditions			Aetiology Immunisation
Death and disability	Circulatory diseases	Stop smoking	Case-finding (blood pressure)	Rehabilitation	Aetiology Intervention
	Respiratory	Stop smoking Avoid allergens		Rehabilitation	Aetiology
	External causes	Education Road and home safety		Rehabilitation	Aetiology
Disability	Psycho-social	Family Planning		Medical education Rehabilitation	Aetiology
	Central nervous system			Rehabilitation	Aetiology Natural history
	Musculo-skeletal			Rehabilitation	Aetiology
	Eye and ear			Rehabilitation	Evaluate screening
	Dental caries	Fluoridation	Dental check-ups		

greater emphasis on, say, particular age groups. *Table 4* does, however, give some indications of where the most effective action might be taken at all stages of preventive activity.

Cost effectiveness must not be forgotten when any preventive measure is considered. Too often in the past a preventive measure has been introduced before its value has been established and public pressure may then prevent its withdrawal. It may even be found that the cost of preventing a particular disease entirely is prohibitive when compared with the cost of treating each case and different methods of prevention deserve the same attention: in the case of an infectious disease, such as cholera, prevention by sanitary measures may be just as effective as expensive immunisation of entire populations [46].

One way of distinguishing between different preventive measures and thus perhaps establishing their relative importance, or which is most appropriate for local circumstances, is to consider whether a measure is the responsibility of society as a whole, that of government or public health authorities or of the individual. For primary prevention of infectious diseases, examples of *societal* measures include the pressure for acceptable standards of nutrition, housing and sanitation which may be the same as *government* measures, which also include the provision of immunisation services and both of these are then supported by the onus placed on the *individual* to make use of the services provided. *Table 5* illustrates the distinction between these three responsibilities as well as the inevitable overlap.

In the prevention of non-communicable disease the emphasis may be different but the three areas of responsibility remain the same: societal actions include attitudes towards such habits as smoking, inappropriate diet and excess alcohol intake; public health and governmental measures include taxation on cigarettes and alcohol, health warnings on cigarette packets and perhaps better guidance as to saturated fat content of manufactured foods; clean air legislation and fluoridation of water supplies; measures which are the responsibility of the individual are largely a question of self-will, i.e. the will to give up smoking, reduce weight by sensible dietary control, and take exercise. *Table 6* again illustrates the areas of responsibility and the overlap between them.

All these measures are, of course, primary preventive measures which prevent the disease state becoming established. Some preventive measures may also be

Table 5

Examples of preventive measures for infectious disease

	Societal	Government/public health	Individual
Primary	Attitudes towards: nutrition housing and sanitation	Maintenance of adequate nutrition housing and sanitation immunisation services	Hygiene immunisation uptake
Secondary	Public pressure for x-ray uptake	Mass x-ray for tuberculosis in the past	Uptake of x-ray where recommended
Tertiary		Rehabilitation for prompt return to work	Acceptance of rehabilitation where necessary

regarded as being related to three areas of responsibility but again the emphasis differs, for example, in screening for the factors associated with coronary heart disease. Reduction of smoking, on the one hand, depends on the persuasion of *society* that it is an unacceptable and worthless habit and, on the other hand, persuasion of the individual, perhaps in relation to his own symptoms, that there is potential harm in continuing to smoke. Detection and treatment of high blood pressure, however, presents a rather different picture with far more onus on the individual first to have his blood pressure tested and secondly to comply with a drug regimen–there is no direct involvement of society in successful secondary prevention.

Thus screening for risk factors can be one of two types: in order to detect and perhaps alter the habits which to some extent become established as a result of societal attitudes; and, to identify altered physiological function in the individual.

Any proposed screening programme must not only adhere to the criteria proposed by Wilson and Jungner [55] but must also take account of what can be expected from the individual if the presence of a risk factor or an abormality is identified i.e. how can he be expected to give up a habit which he enjoys and which is socially accepted and can he be expected to comply with an irritating treatment regimen–especially if at the time of screening he is symptom-free. This quandary leads us full circle to the question of education both of the individual in personal one-to-one situations and of the general public by every means available–advertising, health education and inevitably legislation.

One final point–by searching for effective methods of reducing premature mortality we are creating a rod for our own backs in the shape of an ever-increasing elderly population. Perhaps, far more emphasis should be placed on the disabling diseases of ageing, to ensure that the elderly can continue to contribute within their families and to society, given a societal framework which encourages active participation of all its members and given the employment situation, or at least the leisure facilities, which enables this active participation.

Summary

The importance of individual responsibility in many aspects of preventive medicine is emphasised in the introduction. A section on infectious disease as applied to Western society today follows with special mention of particular conditions such as turberculosis, influenza, rubella, gastro-intestinal diseases and Legionaire's Disease.

The section on non-commicable disease is subdivided into coronary heart disease, malignant neoplasms and chronic bronchitis. It includes some discussion of screening. Short sections on prevention in the elderly, pregnancy and early life, dental health, accidents, alcoholism and drug misuse follow. In the conclusions the difficulty of determing priorities for different societies and the importance of establishing cost effectiveness of preventive measures are covered. The relative importance of societal, governmental and individual preventive measures are described and the authors emphasise that any expensive screening programme must adhere to established criteria.

Résumé

Prévention, la responsabilité de tous

Dans l'introduction, les auteurs mettent l'accent sur l'importance de la responsabilité individuelle dans beaucoup des aspects de la prévention. Puis ils décrivent la situation dans le domaine des maladies infectieuses telle qu'elle se présente actuellement dans les pays occidentaux. Les cas de la tuberculose, de la grippe, de la rubéole, des affections gastro-intestinales et de la «maladie des légionnaires» entre autres sont discutés plus en détail.

Parmi les maladies non-transmissibles sont traitées en particulier les affections coronaires, les tumeurs malignes et la bronchite chronique (les maladies cardio-vasculaires, les cancers et les affections respiratoires sont dans nos pays les trois «fléaux de l'âge moyen»). Les auteurs parlent à ce sujet du dépistage systématique (screening). Puis sont présentées successivement les questions relatives à la prévention à propos des personnes âgées, de la grossesse et la petite enfance, de la santé dentaire, des accidents, de l'alcoolisme et de l'abus de drogues. Dans leur conclusion, les auteurs relèvent la difficulté qu'il y a à établir les priorités réelles dans une société donnée (la situation varie de façon marquée d'une société à l'autre)

Table 6

Examples of preventive measures - non-communicable disease

	Societal	Government/public health	Individual
Primary	Attitudes to: smoking diet (weight) exercise alcohol	Taxation on cigarettes and alcohol Health warnings on products Clean air legislation Advertising Fluoridation	Behaviour: smoking diet (weight) exercise alcohol
Secondary	Recognition of disorders	Screening/case-finding: high blood pressure anencephaly and spina bifida breast cancer cervical cancer	Maintenance of doctor-imposed drug regimens e.g. for high blood pressure
Tertiary	Attitudes (family) to care of disabled and elderly	Provision for care of: elderly and disabled	Recognition of need and acceptance of care

et l'importance de déterminer les rapports coût-efficacité des programmes de prévention. La place relative de mesures préventives aux niveaux de la société, des pouvoirs publics et de l'individu est discutée et il est souligné que tout programme de dépistage, souvent onéreux, doit remplir certaines conditions, qui sont maintenant établies et admises.

Zusammenfassung

Prävention – Verantwortung jedes Einzelnen

In der Einleitung wird die Bedeutung des Verantwortungsbewusstseins des Einzelnen hervorgehoben. Es folgt ein Abschnitt, der die übertragbaren Krankheiten unserer heutigen westlichen Gesellschaft, insbesondere Tuberkulose, Grippe, Röteln, Infektionen des Magen-Darm-Traktes und Legionärskrankheit, behandelt. Von den nicht übertragbaren Krankheiten werden Koronarkrankheit, bösartige Geschwulstkrankheiten und chronische Bronchitis getrennt diskutiert. Dabei wird auch auf Filteruntersuchungen eingegangen. Es folgen kurze Abschnitte über Vorsorge bei Älteren, Schwangeren und Kleinkindern, über Zahnhygiene, Unfälle, Alkoholismus und über Medikamentenmissbrauch.

Die Autoren diskutieren in den Schlussfolgerungen die Schwierigkeiten, die bei Ermittlung von Prioritäten für verschiedene Bevölkerungsgruppen entstehen. Sie heben die Wichtigkeit der Ermittlung von Nutzen und Kosten hervor. Schliesslich besprechen sie die relative Bedeutung von gesellschaftlichen, behördlichen und individuellen Vorsorgemassnahmen und betonen, dass jedes kostspielige Untersuchungsprogramm den etablierten Kriterien genügen muss.

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