Public Health Sciences: Challenges and Opportunities

Report of the Public Health Sciences Working Group convened by the Wellcome Trust

March 2004

The Wellcome Trust

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Summary

The public health sciences have played a key role in creating improvements in human health. They function at the forefront of science and policy by informing measures that will maintain a trajectory of health improvement by guarding against new hazards such as emerging infections, environmental hazards and diseases relating to lifestyle. The public health sciences are essential to further our understanding of the relative importance of environmental, lifestyle and genetic causes of disease to identify strategies to improve the wellbeing of the population and to evaluate their impact.

The importance of public health is now being given high prominence following the publication of the Wanless Report: 'Securing Good Health for the Whole Population' Final Report in February 2004[1]. This and previous reports[1 2 3] have highlighted the health improvements that can be achieved when people are fully engaged in their own health and the health service is refocused towards the promotion of good health and the prevention of illness. The Government has announced a White Paper on Public Health to be published in summer 2004[4]. It is vital that the sciences which underpin improvements in public health now attract far greater investment to meet these increased expectations.

The terms of reference of the Working Group[5] convened by the Wellcome Trust were to consider the current state of the public health sciences in the UK and make recommendations on measures that will enhance their impact upon the public health. The Wellcome Trust, as a leading medical research-funding charity, considered a review of the state of the public health sciences timely as the focus in healthcare moves towards disease prevention and health promotion.

The Working Group did not repeat the tasks of a number of major reviews of the public health function.[6 7 8] Instead, it was concerned with the public health sciences and how they relate to public health practice in the inter-related areas of health services, health protection and health improvement.

This report highlights the extraordinary disparity between, on the one hand, the overriding importance of the public health sciences for public protection, service provision and health improvement and, on the other, the limited strategic interest that is taken in their infrastructure and conduct.

Impressive achievements in the biomedical sciences and medical care can obscure the fact that the circumstances in which people live, whether these circumstances are under their personal control or not, are still the major determinants of health.

The focus of the Working Group's report was to consider how interests as all pervading and desirable as these should continue to find themselves in a vulnerable position and to suggest solutions.

The Working Group concluded that a concerted programme was needed to bring together three basic components:

- Routine and other research data that provide the basis for understanding the causes of disease, the determinants of population ill-health and the benefits of treatments and health improvement programmes.
- People competent and entitled to generate, manage, access, and interpret such data.
- A framework for implementing the outcome of public health sciences research through policy implementation.

To this end, the Working Group makes the following major recommendations:

Recommendation 1

An overarching national strategy needs to be developed to secure the future of the public health sciences at a time when the UK health service is being refocused towards the promotion of good health and the prevention of illness.

A national academic public health strategy group, involving all the major relevant governmental and non-governmental funding agencies, should be established and supported at the highest level.

The public health sciences are broad-ranging, comprise a range of disciplines and are supported by a variety of governmental, research council and charitable sources. There is no overarching strategic framework to decide upon priorities, relative roles or appropriate levels of support. The substantial problems identified by the Working Group are symptomatic of the lack of such a strategic interest.

The strategy group should map current investment and future strategy to increase coordination in supporting public health research.

Recommendation 2

The public must be protected from the inappropriate use of personal information. However, some of the newer processes around data protection and issues of patient consent, designed to provide public protection, create unwitting barriers to the conduct of research of clear public value. It is essential to ensure the long-term continued collection, completeness, accessibility and linkage of key data on population health such as mortality, cancer incidence, infectious disease surveillance and health service use that are required for monitoring and improving the public health. It is necessary to establish the degree to which public health research is being impeded by the current and developing regulatory framework through a dedicated piece of research to gather further evidence of the barriers.

Whatever recommendations emerge, the practical aspects of the regulatory framework need to be streamlined as these processes can act as a strong cumulative disincentive to embarking upon public health research, and may divert resources unnecessarily away from this area.

Recommendation 3

The academic infrastructure for public health sciences at all levels needs to be strengthened through coordinated, long-term investment.

The public health sciences come to attention intermittently at times of threat, or as a result of particular policy initiatives, while the infrastructure can only be strengthened through long-term investment. The sector is seriously under-resourced in relation to the increased importance of the field and merits incremental investment at all levels (undergraduate, postgraduate, research fellow, lecturer, senior lecturer and professorial) commensurate with the maintenance of the highest academic standards. This will require a concerted programme of long-term investment involving, particularly, the Higher Education Funding Councils, the Department of Health, the NHS and research-funding bodies supporting academic posts.

Recommendation 4

The partnership between the universities and the NHS in the public health field should be re-established and public health centres should be established to bring together public health science, social science and public health service delivery.

In the past there was reasonable complementarity between the academic and service public health sectors but recent reorganizations have altered such relationships. This partnership is essential for the engagement of the academic sector with issues of direct importance to population health and is a legitimate source of financial support. It is also essential to strengthen the service sector's ability to evaluate programmes and enhance evidence-based policy. The partnership must be re-established through a variety of means, such as joint training

programmes, joint posts, mobility between the sectors, the establishment of public health centres, encouragement of local support, and the commissioning of research and reviews of public health prevention programmes.

Recommendation 5

A more informed dialogue between public health scientists, the public, policy makers and the media must be engendered to develop a better understanding of risk in relation to health.

This dialogue should be promoted through education, open presentations on the background to public policy and more collaborative engagement by public health scientists of the public, policy makers and the media. Policy and practice should be based on high-quality, empirical research, not on unevidenced assumptions about the public's response.

1. The role of the public health sciences

The public health sciences are concerned with identifying the major current and potential health problems in the population, their determinants, and implementing and evaluating the outcome of programmes designed to reduce the impact of those health problems.

1.1 Definitions

A practical definition of the public health sciences would be those academic disciplines relevant to understanding and improving public health. Such a definition is dependent upon a common understanding of the term 'public health'. While acknowledging the extensive definitional discussions that have been conducted in the field, the Group was comfortable to follow the Acheson definition of public health:

> *"the science and art of preventing disease, prolonging life and promoting health through organised efforts of society."* [6]

The Group developed this description of the public health sciences:

> *Effective public health actions are based on scientifically derived information about factors influencing health and disease and about effective interventions to change behaviour at the level of the individual, the family, the community or wider society.*
>
> *Traditionally, the basic sciences of public health have been considered to be epidemiology and biostatistics but increasingly, there is an awareness that multi-disciplinary perspectives are needed in order to understand a range of influences on behaviour and to develop effective strategies to improve health. This requires contributions from the biological, physical and social sciences, including disciplines such as economics, sociology, anthropology, demography, nutrition, psychology and policy analysis.*

1.2 Achievements, opportunities and challenges

The impact of the public health sciences on health improvement has been enormous. Achievements include, among others:

- the profound impact of the sanitary reforms of the 19th century in reducing infant mortality and cholera;
- approaches to infectious disease surveillance that have helped in the identification of new and emerging infections;
- the development of epidemiological methods in uncovering the hazards of smoking in the mid-20th century;
- the eradication of smallpox and the success of expanded programmes of immunization;
- identifying the hazards of diagnostic irradiation;
- the determination of the importance of fetal and early life origins of adult disease;
- demonstrating the role of interventions in the prevention of coronary heart disease deaths such as lipid lowering, blood pressure control and aspirin;
- measuring the risks of contraceptive pills and hormone replacement therapy.

The public health sciences have enabled the acceptance of the principle that public health interventions should be evaluated through randomized controlled trials where this is feasible. Further, they have enabled the development of trial methodology and methods for combining the results of different studies in order to gain robust estimates of effect.

The potential of such advances to make major changes to population health in real time are the compelling reason for continued research in the public health sciences and provide the rationale for engaging the enthusiasm of the most promising junior researchers to enter this field.

1.2.1 Public health questions

Public health research is not short of big questions to which it can generate answers. For example:

- What are the modifiable determinants of successful ageing?
- How can the current trends in diabetes and obesity be halted or reversed?
- How do exposures experienced across the life course interact with fetal exposures in the causation of chronic diseases like cancer and coronary heart disease?
- What are the most appropriate models of preparedness for emerging, particularly communicable, diseases?
- How does climate change affect health?
- Which measures are most likely to reduce inequalities in health?
- Why is smoking behaviour so resistant to change among some social groups?
- Do dietary micronutrients influence cancer and heart disease risk?
- Which treatments are of proven effectiveness?
- How can the cost of treatments be related to their benefits?
- How can the new genetic understanding be exploited in the best ways for understanding the interaction between genetic, lifestyle and environmental influences in the generation of chronic disease?

With such a wide range of questions, the challenge is to create research environments within which such questions can be broken down into testable hypotheses and a cumulative evidence base created.

There have been periods of strong investment and momentum in the public health sciences and periods where these subjects have been at a relative disadvantage. A recent analysis of the scientific foundations for health improvement[9] concluded, like the Working Group, that the most recent period has not been favourable to optimize the conduct of public health sciences research.

No-one argues that public health sciences are not important nor that they do not require long-term investment and planning, but they tend not be given much public attention or priority in the absence of a crisis. This report highlights those longer-term measures that must be taken on a continual basis to secure the continuing sustenance of a high-level capacity in the public health sciences.

1.2.2 Accelerating expectations of the public health sciences

The Working Group's report is timely as the expectations upon the public health sciences are set to increase markedly in light of the interest now being taken in refocusing the UK health services upon the promotion of good health and the prevention of illness.

The emphasis upon public health is being reflected in new policy initiatives including, for the first time, explicit public health standards whereby healthcare organizations in the UK must:

> *"implement effective programmes to improve health and reduce inequalities"* and *"protect their populations from identified current and new hazards to health".*[10]

The Wanless report published last month focused particularly on prevention and the wider determinants of health in England and on the cost-effectiveness of action to reduce health inequalities deriving from societal influences. The report highlighted the very poor information base underpinning public health and states:

> *"To address the almost complete absence of an evidence base on the cost-effectiveness of public health interventions, substantial investment will be necessary, backed up by building the capacity of the public health research sector in England, establishing clear priorities and ensuring that responsibility to collate what evidence does exist is assigned."*

The modelling undertaken for the first Wanless review in April 2002[2], of long-term trends affecting the health service, suggests that if the level of public engagement in relation to health is high, the adoption of effective public health measures could be expected to reduce demand pressures in the longer term. Life expectancy would go beyond current forecasts and health status would improve dramatically, while the use of resources would become more efficient.

In its most recent research strategy[11] the Chief Scientist Office (CSO) of the Scottish Executive Health Department identified public health as one of four priority areas in which it would seek to develop a more detailed strategy to ensure that new research addressed questions of acknowledged importance and that obstacles to conducting such research were systematically identified and tackled.

This new emphasis upon public health must depend upon sound research evidence to plan public health interventions and continuing evaluation to understand the outcomes of such policies. This is particularly important in the context of the first Wanless review's expectation that a significantly larger proportion of national income will be devoted to healthcare in the UK over the next 20 years, and that:

> *"Greater research effort is needed in order to model the major determinants of health with greater precision than is currently possible, to include macroeconomic policy, individual human behaviour, environmental factors and therapeutic and preventive interventions."* [12]

Given that the gap in cost between the most and least favourable healthcare scenarios in 2022/23 is estimated to be around £30 billion, or half of current NHS expenditure[13], and where a key factor in securing the more favourable outcome is the effectiveness of public health strategies, the need for a substantial increase in investment in the public health sciences is obvious.

1.2.3 Population and individual health

Public health is concerned with preventing disease and improving the health of *populations.* The training, skills and activities underpinning public health are therefore necessarily different from those underpinning clinical care, where the major objective is the diagnosis and treatment of an *individual* patient's particular predicament.

The differences in approach to *population health* and an *individual's disease* gives rise to the operation of different values and priorities. However, the values and priorities in population health are becoming far more relevant to individuals' clinical care with the advance of evidence-based medicine. There are increasing requests from policy makers for evidence of the benefit and affordability of clinical interventions. Therefore, the techniques and skills of the public health sciences are in increasing demand to inform and evaluate evidence-based medicine as well as needing to maintain its traditional role in population health.

For the public health sciences to successfully fulfil this expanded role, those who work in health services providing clinical care, and also in social services, education, local authorities, transport and many other areas where health is influenced, need to have a greater understanding of what the public health sciences have to offer to improve the effectiveness of the service they provide.

1.3 Research methodologies and multidisciplinarity

The growth in public health sciences over the last century was stimulated by a better understanding of the major determinants in health. This was informed by developments in the underlying infrastructure of national vital statistical data. Data became available from health surveys, disease surveillance and the results of large, long-term population based studies. The availability of these data has led to methodological developments that have been applied to public health problems[14]. Such methodological developments include:

- multi-factorial and life course aetiology paradigms;
- research synthesis;
- meta-analysis and cross-design synthesis;
- weighting of costs and benefits of healthcare interventions;
- measurement of disease burden, including disability adjusted life years and healthy active life expectancy;

- measurement of health status, including quality of life indicators and impairment-disability-handicap models;
- national health surveys and demographic surveillance sites;
- evidence-based practice;
- toxicology and risk assessment;
- molecular and genetic epidemiology;
- integration of sociological and anthropological research techniques with quantitative methods to facilitate understanding of the processes of healthcare;
- social marketing, including the use of mass media in health promotion.

As well as involving a variety of methodologies, tackling public health problems very often requires scientific input from more than one discipline, depending on the particular issue in question. For example, the response to the recent outbreak of SARS was notable for the speed and effectiveness of traditional contact tracing procedures, the rapidity with which the virus was genotyped and the use of traditional public health measures such as quarantine and isolation. HIV/AIDS research has involved biologists, the pharmaceutical industry, psychologists, sociologists, anthropologists concerned with the social dynamics of transmission and mathematicians involved in modelling future scenarios. The independent expert group on mobile phones included a physicist, a neurophysiologist, a statistician, an environmental epidemiologist, a cognitive neuroscientist, a radiobiologist, a consultant neurosurgeon and an engineering and telecommunications expert. Also, health economists collaborate with scientists on a wide range of public health research projects.

Thus the umbrella needed to cover all potential public health scientists is necessarily very wide and it may include under its shade a range of scientists with initially little in common and who may not share working methods or assumptions.

Unlike some other areas of science, the public health sciences, drawing as they do upon a variety of primary disciplines, currently have no specific champion. Specialists from other disciplines are likely to identify themselves first and foremost with their principal specialty and not describe themselves as public health scientists.

Specialists from a variety of disciplines coalesce when there are perceived or real threats to the public health. The precautionary principle[15] can mean that each threat may require a forceful response. However, once the threat is dealt with, these groups disband and there is no collective memory or patterns of work that could be built upon to permit smoother and more rapid deployment of the relevant scientific teams in the event of the same or similar threats. Furthermore, threats that are not perceived by the public (or their elected representatives) are in general not dealt with at all, so that the public health sciences have tended to operate in a responsive rather than proactive mode.

1.4 Education and training

The educational role for the public health sciences is key to their future resilience. There are four groups that should be engaged and involved with this:

1.4.1 Public health scientists

We need to invest now in the next generation of specialist public health scientists to prepare for the increasingly important role that they will need to play, given the high prominence that public health is currently receiving from Government. In particular, epidemiologists, statisticians, specialists in communicable and other diseases, sociologists, economists, anthropologists and psychologists who wish to direct their activity towards public health issues need to have the opportunities for education and training in the public health sciences.

Public health activity requires strong interdisciplinary academic training environments starting from undergraduate level right through to the availability of research studentships, training fellowships and good postdoctoral career prospects.

1.4.2 Public health specialists

There are a number of professions whose work requires a good understanding of the population context of disease. These include public health specialists with medical, scientific, nursing, environmental science and other backgrounds involved in the areas of health improvement, health protection and health and social care. Training schemes have been long established for public health physicians and environmental health officers. The recent acceptance of the multidisciplinary nature of public health practice has led to a widening of these opportunities, but much progress still has to be made.

1.4.3 Clinicians and other health workers

The effectiveness of those working in a wider health or clinical context, such as doctors, nurses and managers, would be enhanced by a public health perspective. Public health has been a core component of medical education for doctors for some time. The future generation of doctors must understand public health in order to appreciate the impact of wider socioeconomic factors on the management of their patients and in order to support evidence-based practice through clinical epidemiology. This training is expanding in nursing education but is less developed in the training of other groups involved in healthcare.

1.4.4 Policy makers and the public

There is a real need for a more developed understanding among policy makers and the public as to the nature of public health risks, how to understand them and how to make rational decisions about preventing ill health. Public debate can be ill informed and the basic point that public health deals with probabilities not certainties is not always conveyed well to the public.

1.5 International contexts

The support of research to address the pressing public health problems such as HIV/AIDS, TB and malaria in low-income countries is beyond the scope of this report. However, global factors do influence health in the UK and public health research overseas can inform public health research in the UK. Changing global patterns of trade may affect the types of employment available in the UK and so, for example, the decline in manufacturing industries may change the range of occupational health issues experienced. Global trade policies can have wide-ranging impacts on health by influencing access to essential pharmaceutical drugs, export of products harmful to health and trade in health services. Smuggling of tobacco, illegal foodstuffs, the international flow of narcotics, the influx of refugees and economic migrants and illegal human trafficking all pose a range of public health issues for the UK. Climate change and other global environmental issues will also have an impact.

Much can be learnt by the UK from the study of how other industrialized countries are reacting to pervasive challenges such as ageing populations, childhood obesity and drug misuse. Indeed, both developed and developing world countries can make gains in public health research by comparing their statistical data and the results of public health interventions with other nations.

Public health scientists and funding bodies in the UK need to be more active in identifying the potential for international collaborative research to address issues of public health importance both in UK, in the collaborating country or countries and ultimately, globally.

2. Barriers to the conduct of public health research and monitoring

2.1 The regulatory environment

Public health sciences are concerned with the health of populations and therefore cannot function without ready access to population data and routine biological samples. A key requirement is the availability of reliable and complete population-based data and samples for assessing health status and trends. Routine vital statistical data such as mortality data, cancer incidence and infectious disease surveillance systems are essential.

Opportunities

The advent of large primary care databases, research networks and the closer working relationships between primary care and public health at the local level, have created real opportunities for epidemiological and other public health research in the context of primary care.

These large primary care databases provide unparalleled potential for monitoring the progress of policy interventions and for undertaking large scale pharmaco-epidemiological studies, studies of the impacts of vaccines, work on environmental determinants of common diseases and studies of the epidemiology of diseases of unknown cause (such as autoimmune diseases, Crohn's disease, autism etc).

In addition, primary care is the site of many preventive and health promotion activities and provides opportunities for large-scale trials of public health interventions to be delivered by primary care staff.

The UK has an advantage over many other industrialized nations in that it has a national health service. This should enable the population to benefit from an expanding knowledge base concerning population health trends, the safety and effectiveness of interventions and the impact of environmental influences upon health. This case was persuasively and comprehensively made over 15 years ago[16] and more recently in a report of the Department of Trade and Industry's (DTI) Bioscience Innovation and Growth Team[17].

Barriers to accessing data and samples

However, while the technical capacity to gather information which could be used in public health research has increased immeasurably, the regulatory environment concerning access to patient information and the use of databases and record linkage has become increasingly adverse for public health and other researchers.

The scientific validity of any study on outcomes of clinical or public health diagnostic, prevention or treatment interventions, depends on the completeness and accessibility of the patient information and other research data. It is essential that the regulatory environment for public health research allows modern technology for data collection and linkage to be harnessed to benefit public health.

Any system that requires voluntary participation to statistical databases, as was proposed for cancer registries but later withdrawn[18], would threaten the completeness and value of such data. To get the most accurate data, it is vital that the independent health sector also provides equivalent data.

In the past, researchers were granted ready access to identifiable patient information and to clinical records and important findings emerged from such studies. A classic example is the association between abdominal X-rays during pregnancy and childhood leukaemia.[19]

The increased emphasis on the privacy and autonomy of the individual prevents reliance by public health researchers upon direct access to patient records. However, the possibilities of utilizing anonymized or linked anonymized patient information and other research data and the options available within the broad concept of consent,[20] must be fully utilized so that public health research (and indeed, clinical research of public benefit) is not obstructed.

The NHS Care Records Service[21] within the NHS may help to address this challenge by allowing data to be provided for research purposes in a form that supports record linkage but does not identify individuals. The specification for the NHS Care Records Service states that the *"service must support local and national research initiatives"*. It must be ensured that access to data for public health research is seen as a key purpose of the NHS Care Records Service and is not regarded as a concession.

The Working Group regards the need to protect the confidentiality of the individual as unequivocal. However, there remains strong concern that the current regulatory environment, which is intended to provide public protection, has created significant barriers to public health research being carried out.

In England and Wales, Section 60 of the Health and Social Care Act 2001 (leading to the establishment of the Patient Information Advisory Group) provides a power to ensure that patient identifiable information needed to support essential NHS activity can be used in appropriate cases without the consent of patients. The power can only be used to support medical purposes that are in the interest of patients or the wider public, where consent is not a practicable alternative and where anonymised information will not suffice. It is intended largely as a transitional measure whilst consent or anonymisation procedures are developed. This is reinforced by the need to review each use of the powers under Section 60 annually.[22] In Scotland access to patient identifiable information is regulated by the recommendations of the Confidentiality and Security Advisory Group, 'Protecting Patient Confidentiality'.[23]

Although there are now some signs of a consensus emerging on how best to proceed[24], there continues to be a perception that researchers are being inhibited from undertaking research due to uncertainty about how to proceed or where to obtain advice.

The Working Group had anecdotal evidence that there were a number of factors in play that were, to varying degrees, hindering public health researchers accessing research data and biological samples. It is perceived that these barriers may be caused by the following current or proposed legislation, law or processes, or by the interpretation of them:

- the Data Protection Act 1988;
- the common law on confidentiality;
- the Human Tissue Bill;
- the Human Rights Act;
- the stance of local ethics committees;
- the application of Section 60 of the Health and Social Care Act 2001;
- the requirements of clinicians' regulatory bodies regarding patient confidentiality;
- the Medicines for Human Use (Clinical Trials) Regulations 2003.

The interaction of some or all of the above factors were perceived by the Working Group to act as a strong cumulative disincentive to embarking upon research that depends upon population data. It was felt that a number of these disincentives were unwitting and could thus be lessened. Both the Academy of Medical Sciences[25] and the latest Wanless Report has highlighted this same issue. The Wanless Report states that:

> *"[an] issue reported to be undermining the capacity for public health monitoring and research is that information has become harder to access. The difficulties of obtaining access to information may be creating disincentives to undertake public health research.…There is a clear need to seek consensus and clarify the balance between access to data and protection for individuals….The White Paper should address the possible threat to public health research, which arises from the difficulty of obtaining access to data because of the need to strike a balance between individual confidentiality and public health research requirements."*[26]

The process of mounting a population study

All successful high-quality research depends upon strong personal motivation on the part of the researcher, but it can require exceptional determination on the part of an individual to mount a population study. The permission processes can now be so protracted that an individual researcher's (particularly a young researcher's) investment in attempting to mount such research could be seen as an unwise career choice.

In order to embark on a population study, ethical approval must generally first be granted by a local ethics committee. There is a perception that local ethics committees often misunderstand population research. Their recommendations and conditions as to the conduct of population research sometimes appear ill informed and

arbitrary and there is no appeal mechanism when their recommendations and conditions seem overly restrictive. Should individual consent for data access be problematic, exemption from common law requirements through Section 60 of the Health and Social Care Act cannot be sought until ethical approval for the research has been obtained.

Interpretations of the Data Protection Act can make the initial task of identifying and recruiting a suitable study population insurmountable. Differing interpretations of the Act by local officials can prevent researchers from accessing and identifying clinical registers (e.g. data on persons with particular conditions such as cancer, Parkinson's disease, autism) or population-based registers (e.g. primary care age sex registers).

Even if access to clinical or population-based registers is possible, local interpretation of the Data Protection Act often prohibits researchers from contacting potential research participants directly with information about the research and a request to participate. Instead, they may be asked to make a first approach via the clinician, who would have to ask potential participants for their permission to be contacted by researchers. These constraints make it exceedingly difficult to even get a population-based study started, particularly with limited resources and time.

Additionally, even when potential participants have in the past clearly indicated a willingness to participate in research by allowing access to their medical records and biological samples, the increasingly limited and rigid interpretation of what constitutes consent constrains even more what can be achieved in population studies.

Biological samples

The Human Tissue Bill[27] is intended to strengthen the legal framework following inquiries into procedures at Alder Hey Children's Hospital in Liverpool and the Bristol Royal Infirmary, where tissue and organs from deceased children were often retained without parental knowledge or consent. The aims of the Bill are well intentioned but, as currently drafted, the Bill could have very serious consequences for public health (and other medical) research.

For example, crucial research involving routine testing of small samples of tissue (including body fluids such as blood, saliva and urine) could be prohibited without explicit consent from the patient. There is currently no definition of 'consent' in the Bill and so how the Bill would be applied in practice is not clear. Research funding agencies are currently in discussions with the Government and the science community in an effort to find a satisfactory solution.

It is vital that any proposed solution takes into account the needs of public health researchers to have access to patient information. Access to tissue samples restricted to those where explicit consent to use them has been obtained, will have limited external validity. This is particularly likely to undermine public health surveillance of communicable and other diseases where it is very likely that those not consenting have very different disease patterns from those consenting. In addition, hypotheses often can emerge after samples have been collected, making explicit prior consent impossible to acquire.

These same barriers to research are also being placed in the conduct of communicable disease outbreak investigations where the risks to public health is far more immediate than in the case of longer term public health research.

The Department of Health has taken a very public stand on the issue of consent. In response to the Royal Liverpool Children's Inquiry health ministers said that, *"the traditional paternalistic attitude of the NHS, that the benefits of science and research are somehow self-evident, was no longer acceptable"*.[28]

The Working Group believes that the public should be encouraged to contribute to research where this requires nothing more intrusive than the storage and analysis of routine data and samples conducted under rules of confidentiality. This can only be achieved by engaging with the public on what public health and other medical research can do for them.

Instead of imposing blanket restrictions on access to patient information without universal consent, the possibility of class access for accredited academics, or class exemption being granted under Section 60 of the Health and Social Care Act should all be explored as possible ways to improve the regulatory environment.

Regulatory environment in other countries

The experience overseas certainly suggests that there is some flexibility in the interpretation of the Data Protection Act (which implemented the provisions of a European Directive on data protection) and the Human Rights Act (which implemented the provisions of the European Convention on Human Rights into UK legislation). Lessons could be learned from comparing practice between European member states and other European countries as it appears that these legislative requirements from the European Commission have quite different implications for research in different countries. Population research based upon routine data sources does appear to receive continuing acceptance and support in some countries. Scandinavia, in particular, has a favourable climate for population research data, as does Scotland in comparison to England.

Review of the regulatory environment in the UK is required

It is important to stress that the time taken by researchers seeking the permissions required to mount a population study comes after success in obtaining research funding, which can in itself be a long process. Even a successful funding application will usually have involved numerous iterations in response to panel and referee comments. Where success in securing funding can require years of negotiation with funding bodies, together with an arduous process of obtaining permission to conduct the research, by the time the study is possible, it may no longer be timely or viable.

There is also a danger that the implementation into UK legislation of the EU Directive on clinical trials will add further hurdles.[29]

The considerable amount of time it takes to mount a population study is a questionable use of research capacity. Public and charitable bodies are funding research of public value and yet the individual researcher often finds him or herself in a somewhat adversarial relationship with the regulatory processes.

The Working Group recommends that a survey of public health researchers should be undertaken to gather further evidence of the barriers in the current regulatory framework governing the collection and management of and access to patient information and other research data. The report of the survey's findings and recommendations for change to streamline the approval processes for public health research should be published.

3. Support for public health research

The major agencies, including Government, research councils and major research-funding charities, do support the public health sciences, explicitly or as a part of other programmes. For example, the MRC has run a Health of the Public Initiative[30]. Its recent call for proposals elicited applications from a wide range of disciplines and multidisciplinary collaborations. The MRC also has an annual competition for Special Training Fellowships in Health Services Research and Health of the Public.[31] The Department of Health's Policy Research Programme has invested in research on smoking (*c.*£4 million over six years), inequalities in health (*c.*£4 million over five years) and sexual health and HIV (£1 million annually allocated through the MRC). The NHS R&D currently funds two schemes specifically targeted at Public Health.[32]

Notably, around 20 per cent of the direct research spend of the Chief Scientist Office (CSO) of the Scottish Executive Health Department is on public health research.[11]

The Wellcome Trust has supported a variety of programmes, including the Wellcome Trust Research Training Fellowships in Clinical Epidemiology scheme that has provided much of the academic leadership to the discipline. In addition, the Trust is currently restructuring its funding so that, from Autumn 2004, one of the new streams will be for funding population and public health research, in recognition of the central role that this area should play in improving health.

However, the Working Group's review of research support generally suggests that the public health sciences are not adequately supported. For example, it has been suggested that less than 4 per cent of MRC awards between 1995 and 2000 were relevant to public health interventions.[35] While the MRC's Public Health and Health Services Research Board spend has increased, most of that increase is due to an increase in spend on drug trials and not on wider public health research. However, the MRC's 'A Vision for the Future 2003' indicates that the MRC intends to place a greater emphasis on public health.[33]

The recent report of the National Cancer Research Institute (NCRI) on strategic direction in cancer research identified cancer risk and prevention as of low direct research activity (2 per cent of the total cancer research budget) even though there are clear scientific opportunities.[34]

One manifestation of the relative neglect of this area is that the evidence base that would inform public policy is weak; it was noted in a recent review of overall academic and research output that only circa 0.4 per cent of UK publications recorded on MEDLINE were relevant to public health interventions.[35] Also, the April 2002 Wanless review noted the paucity of evidence that would allow understanding of the relative merits of public health and healthcare expenditure.

Even in the area of funding for trials there is concern. A recent review concluded that:

> *"the future of non-commercial randomised controlled trials in the United Kingdom has been threatened by the discontinuation or demise of national and regional NHS research and development programmes. Support also seems to be declining from the Medical Research Council and the medical research charities. It is unclear what the future holds for randomised controlled trials that address issues of no interest to industry but are of great importance to patients and practitioners."* [36]

It appears that the Government is beginning to address the concern with the announcement in November 2003 that it would establish a working group to develop practical proposals for improving patient benefits from research relating to clinical trials and translational research within the NHS[37] in response to the DTI's 'Bioscience 2015' report.[17]

However, the current inadequate support of the public health sciences from public and charitable sources sends strong negative signals to young researchers planning their careers. Nevertheless, there are signs that the importance of investing in this area is starting to be recognized and the situation may be about to improve.

Support for the public health sciences overseas

The Group is aware that the problem of a lack of strategic funding for the public health sciences is not unique to the UK. For example, the Institute of Medicine's (IOM) recent report on the future of US public health[38] commented upon:

> *"…outdated and vulnerable technologies; a public health workforce lacking training and reinforcements; antiquated laboratory capacity; lack of real-time surveillance and epidemiological systems; ineffective and fragmented communications networks; incomplete domestic preparedness and emergency response capabilities; and communities without access to essential public health services… although these problems became apparent in a time of crisis, they gave rise to concerns about the integrity of the day-to-day functioning of the structures that promote and protect the public's health in the face of food safety issues, exotic or re-emerging microbes, and escalating chronic disease."*

In addition, the American Association of Schools of Public Health (ASPH) has recently urged the US government to significantly increase public health funding. ASPH is of the view that modest expenditure on public health research and training now would translate into significant health savings later. ASPH estimates, based on figures in an IOM Report[39] that 40 per cent of deaths in the US can be linked to preventable conditions and yet IOM figures show that only 1–2 per cent of the US healthcare budget is spent on prevention, and a like imbalance exists between funding for basic biomedical research and for population-based prevention research.

A review of public health in Canada[40] pointed to the international problem of:

> *"the lack of interest in decision-makers to address public health infrastructure unless faced with a specific health issue or crisis".*

From its international survey of approaches to public health research and development, the Canadian review noted:

> *"…overall lack of funding; lack of funding for implementation research; lack of transparent process of prioritizing public health research; fragmentation of funding across many bodies without any coordination."*

The Working Group was struck by the lack of coordinated strategic support for the public health sciences both in the UK and overseas. In the UK, while a number of funding agencies had programmes that contributed to the area, none led on these issues. As public health science issues are wide-ranging and complex, and indeed international, they cannot be tackled by a single academic group, government department or research council. Partly in consequence of this, there is no organizational champion or coordination of this area of work.

Need for a national strategy

The substantial problems identified by the Working Group are symptomatic of the lack of such a strategic interest in the public health sciences. An overarching national strategy needs to be developed to secure the future of the public health sciences at a time when the UK health service is being refocused towards the promotion of good health and the prevention of illness.

In 2001, the Department of Health proposed that a public health R&D group should be set up as a part of its R&D Strategy for Public Health.[41] The need for better cross-funder coordination is more pressing than ever if support for the public health sciences is to match the significantly increased need for investment in this field.

The merits of inter-agency funding have been demonstrated with the success of the National Cancer Research Institute (NCRI).

A national academic public health strategy group involving all the major relevant governmental and non-governmental funding agencies should be established and supported at the highest level.

The Wanless report makes the same recommendation.[42]

A mapping exercise by a time-limited group could provide the basis for the development of a national research strategy for public health, including a framework for increased and coordinated funding for public health research. This could address the disadvantages faced by the public health sciences.

To address the support requirements for public health research, a number of specific issues need to be considered as follows:

3.1 Public health protection

Health protection, as a key function of public health responsibility, has important interrelationships with other policies such as tackling inequalities and promoting a healthier population. The main areas of health protection are the control of infectious disease and responses to chemical and radiological hazards.

The mistaken view initiated by the US Surgeon General some 30 years ago – that communicable disease would become a less important public health issue – led to a major diminution in training and research funding in this area. The current microbiological research deficit within the UK is a matter of major concern. This has been highlighted by the Academy of Medical Sciences[43] and, more recently, by the House of Lords Select Committee on Science and Technology[44]. Capacity must be expanded in relation to biosecurity, potential pandemics, modern microbiological diagnostics, surveillance, epidemiology, modelling, antibiotic resistance and blood borne viruses, among others.

The areas of radiological and chemical hazards and poisons are in stronger positions, though it is also important to stress that the separate treatment of each of these areas is misleading, as there are many areas of interaction. For example, there is interaction between radiation effects and chemical effects, between antibiotic resistance and drug use, antibiotic resistance and drug design, between diagnostics, genetics and vaccine production.

There is great potential for collaboration between public health protection and the social sciences as the risks, real and potential, are likely to escalate and public responses to these must be understood. There has to be better appreciation of risk and how risk is managed, of the precautionary principle, of the balance of evidence and an understanding that what is best for the individual may not be best for the public at large.

At the service delivery end of public health protection the Government has established the Health Protection Agency[45] (HPA) to bring together expertise in relation to biological, chemical and shortly, radiological hazards. This offers the opportunity to redress the decline in microbiological academic research capacity through collaboration between the HPA, research funders and the university sector.

In the medium to longer term, the HPA can foster the establishment of microbiology research and training facilities within certain universities. This area of the public health sciences highlights the crucial links between academic science and practice. For example, in the case of the development of vaccines, collaboration between academic researchers and those working at the service delivery end of public health is essential. The importance of establishing training facilities as a collaboration between the HPA and universities applies equally to radiation, chemical and poisons hazards.

The global dimension of health protection, the necessity of which was highlighted by the SARS epidemic, must be incorporated into these developments. Recognizing that tackling public health threats requires a much closer cooperation between European members states and the World Health Organization, the European Parliament has now agreed on the establishment of a European Centre for Disease Prevention and Control (ECDC).[46]

The ECDC is intended to provide a structured and systematic approach to the control of communicable diseases and any other health threats which affect EU citizens and to mobilize and significantly reinforce the synergies between the existing national centres for disease control.

The HPA brings together interests in some aspects of risk but, in general, public health has failed to establish its core skills in a single authority. For example, aspects of environmental health such as transport, water and air quality are monitored by other agencies that lack insights into the health consequences of such environmental exposures. Public health observatories[47] might have the potential to fulfil such a role and have been developed with academic links. However, funding for the public health observatories has been variable and their remit has not been developed. They could perhaps be further developed to provide the critical mass and infrastructure to fulfil the function of public health centres to provide coordinated initiatives.

The Working Group recommends that public health centres are established in the UK to bring together academic public health scientists, social scientists and the HPA and others working at the service delivery end of public health, in order to improve collaborative working on public health issues.

The House of Lords Select Committee on Science and Technology reached similar conclusions in its examination of communicable disease control[48] as did the Wanless Report.[49]

4. Academic capacity in the public health sciences

The future strength of public health delivery must depend upon the present and future strength of academic public health. There are conspicuous areas of international excellence for these subjects in the UK, but overall there are serious concerns about the current strength and future capacity of the sector.

Solutions lie partly in the way that the universities, the Higher Education Funding Councils and others invest in capacity for this sector and partly in the relationships between institutions and between the relevant disciplines.

A survey of academic departments in England was conducted in 2000/2001.[50] At that time, there was heavy reliance upon NHS funding for senior public health medicine positions when 44 per cent of Lecturer, Senior Lecturer/Reader and Professorial posts in public health departments were funded by non–Higher Education Funding Council sources. The 2000/2001 survey indicated that there was a reported shortage of suitable applicants for lecturer posts and it was clear that university-based posts constituted only a relatively small percentage (well below 10 per cent) of total NHS–funded training posts in public health.

4.1 The University sector

It is a matter of concern that senior academic posts and academic leadership in the public health sciences receive relatively little support from central university funds, given the strategic importance of these subjects and their increasing role in educating the expanding numbers of medical students and other health workers. Improving this situation will require a long-term strategy, as it would be unwise to expand capacity where such expansion is not competitive within the rigours of university funding.

The Higher Education Funding Council in England has introduced the concept of 'capability funding'[51] to support selected research areas in health. Consideration should be given to whether the public health sciences could be included in this or a new ring-fenced funding stream.

The public health sciences should be able to function successfully in a mixed economy where high-level research is rewarded by the Funding Council's assessment process and research which is relevant to policy activity should be adequately supported by those who require it, particularly the Department of Health. Teaching must be supported as well as research, to build upon this knowledge base.

4.2 NHS support for posts and infrastructure in the public health sciences

Restructuring of the NHS and other public health service functions

The public health sciences have developed over the years in partnership with the NHS and the Department of Health. This relationship was particularly strong between the 1974 reorganisation of the NHS and the series of changes that gathered pace during the mid 1990s. Since then the NHS has been undergoing continuous structural change at an increasingly rapid pace and the public health service community has had to fit into the new and emerging structures.

The more recent policy environment has in some respects been positive for public health. For example, the recent focus on health inequalities, prevention as part of all National Service Frameworks, an emphasis on evidence of effectiveness in the regulatory frameworks and recognition of the importance of health protection with the creation of the HPA, all create real opportunities to bolster public health.

Nevertheless, it appears that the changes in the policy environment have been driven more by concerns with patient care than by matters of health promotion and health protection and the Working Group felt that the restructuring over the last decade has had a largely adverse impact upon the public health sciences.

In England and Wales the impact of the Department of Health's 'Shifting the Balance of Power: The Next Steps'[52] was to create new public health posts in Primary Care Trusts (PCTs) as well as further posts in the Strategic Health Authorities. The creation of the HPA has required a realignment of relationships as the communicable disease community moves out of the Public Health Laboratory Service into the HPA and the NHS. There are likely to be further changes as the role of the HPA emerges.

The demise of the Directorates of Health and Social Care[53] also brings with it a changing role for regional public health groups. It is hoped that this will not reduce the ability to fund long-term, strategic research in the public health arena. The Department of Health is being restructured and downsized[54] and the arrangements for managing NHS R&D staff are being adapted to the new structures.

Fragmentation caused by restructuring

Thus specialist service public health is in a state of change and this has led to the interface between academic departments and the NHS becoming unclear and in some places tenuous and fragmented. The expansion of public health interests and horizons ought to bring together a wider group of public health sciences. However, the current situation is not conducive to this being achieved because of fragmentation and the barriers to sustaining a critical mass of public health scientists.

For example, the PCTs, as small organizational units, do not have the ability to 'see the big picture' unless they collaborate to support common facilities, which is not possible within existing arrangements.

NHS funds have been relied on heavily for expansion in staff numbers in university public health departments over the last 30 years or so. This may have been an expression of partnership or it may have been an expression of the failure of the university sector to invest in the public health sciences despite the clear need for such investment for both teaching and research. In any event, this reliance on NHS funds is now at risk. In recent years funding allocations of NHS money to academic departments has decreased and, in some cases, has been lost. This has been due in part through the loss of regionally-funded research support from the NHS and partly through the centralization of NHS R&D funds.

The former symbiotic relationship between academic and service departments, whereby non-clinical academics were involved in local clinical research and clinicians were engaged in university teaching, has also been disrupted or even ended as a result of the pressures of restructuring and real or perceived pressures on funding from the Higher Education Funding Council concerned.

It is important that the new Consultant Contract in England is implemented in such a way to avoid any further confusion in both the source and the purpose of funding streams.

In Scotland, the pace of organizational change has been less hectic and there has been less disruption to these working relationships. Health protection remains the responsibility of the Scottish Centre for Infection and Environmental Health (SCIEH), a division of the Common Services Agency (CSA) of NHSScotland. SCIEH is a large employer of public health scientists, as is the Information Statistics Division of the CSA. Although academic-service relationships in Scotland have been less disrupted by NHS reorganization than in England, financial pressures have affected relations. The number of NHS-funded posts has declined (from a low base) in a number of academic departments. Posts have been left unfilled where a university has been unable to fund the extra cost of a clinical academic and there are concerns about the lack of funded academic specialist training posts to ensure the next generation of public health scientists.

The public health sciences do not have the equivalent of the subsidy for clinical research through teaching hospitals. Although some substantial funding has gone into primary care research networks in the recent past, only part of that research is related to public health issues and arguably there needs to be a public health equivalent of investment in infrastructure for population based research.

The Working Group recommends that the partnership between the universities and the NHS is re-established through a variety of means, such as joint training programmes, joint posts, mobility between the sectors, the establishment of public health centres, encouragement of local support, and the commissioning of research and reviews of public health prevention programmes.

4.3 Career pathways

4.3.1 Doctoral programmes

Vigorous public health science depends upon a continuing output of well-qualified individuals at doctoral level. The 2001/2002 survey[50] of academic departments in England revealed a problem with career pathways, particularly in terms of the relatively low number of postgraduate research students in the public health sciences sector.

At the time the survey was undertaken, a mean level of just over three PhD students per department was found which clearly limits the opportunities for aspiring public health scientists to achieve their critical initial qualification in the area. It suggests also some degree of failure of public health sciences departments to engage in this vital first level research training activity. Potential explanations include a lack of funded studentships or difficulties recruiting to studentships.

The survey also highlighted the relative shortage of postdoctoral posts preparatory to securing a lecturer post. Areas with skill shortages included medical statistics, health economics, epidemiology and medical sociology. This situation must be redressed by an expansion of available studentships and postdoctoral awards commensurate with the expansion of strong academic environments able to absorb them.

4.3.2 Academic and professional training

One of the notable success stories in developing academic capacity in this area has been the Wellcome Trust Research Training Fellowships in Clinical Epidemiology scheme. These Fellows now occupy a high proportion of the senior posts in public health within the UK. A survey conducted by the Wellcome Trust found that 18 of the 92 fellows funded by the scheme between 1979 and 2002 are now professors and the Wellcome Trust fellows' contribution to the total number of clinical epidemiology related research publications in the UK during this period has increased to one in every 13 publications, from less than one in 100 at the start of the initiative.

The Department of Health and the MRC have introduced similar schemes that encompass a broader range of public health disciplines. As long as appropriate standards are maintained, these programmes offer a very efficient means for addressing the shortfall in capacity, and provide a mechanism for strengthening, over a long time frame, the constituent disciplines of public health sciences, including health services research. It is important to accept that this must be a long-term process as existing fellowships have only recently been opened to non-medical disciplines and there is therefore a relative shortage of senior scientists from non-medical disciplines to act as role models.

Until recently, public health career paths for medically qualified specialists in public health were clear. There was a symbiotic relationship between service and academic public health whereby those undergoing academic training could later choose to pursue a service career and academically able specialists working in the NHS could move to academic posts. The fragmentation of the academic-service relationship has made career prospects for medically qualified public health scientists far less clear and the structure for non-medically qualified specialists is even less predictable. This uncertainty means that a career in public health may not be attractive to the ablest potential candidates and this has to be resolved for the good of both academic departments and the NHS.

There is also a perception of an increased tendency on the part of those responsible for clinical training to undervalue academic experience as a legitimate component of public health training. This tendency must be tackled centrally because, of all health service specialities, the capacity to gather and understand population and effectiveness evidence that can be developed in an academic environment is an essential requirement of a public health specialist.

For those at the earlier stages of their academic careers, such as postdoctoral researchers, short-term contracts are an endemic problem, particularly for those from non-medical backgrounds. There is still a preponderance of medically qualified staff (two-thirds) at professorial level, though almost equal proportions at Senior Lecturer/Reader level.[50]

There are particular problems with recruitment and retention of statisticians and health economists because they can receive higher salaries in the commercial sector.

The Working Group believes that steps can be taken to resolve these vulnerabilities in the academic capacity of the public health sciences.

Very similar problems, in relation to the inadequate training opportunities and career pathways for young clinicians willing to undertake research in experimental medicine, have been highlighted.[55] These issues, among others, are being considered by a working party on Research for Patient Benefits.[37] The problems in relation to both public health scientists and clinicians issues invite parallel solutions, i.e strategic investment into these areas and incentives for promising researchers to work in these fields.

The Working Group recommends a medium-term strategy coordinated between the Funding Councils, universities, the Department of Health, the Research Councils and research-funding charities, to ensure that careers in the public health sciences are developed for the most able recruits and to ensure investment in the academic and professional training of public health scientists.

5. Public engagement requiring strategic input

Here we highlight a number of issues that are relevant to the message that the public and policy makers receive about public health research findings.

5.1 Public and political context of public health sciences

The public health sciences deal with areas that are often inherently controversial and may have major political, economic or commercial implications. This fact is apparent from a list of recent or current concerns for the public health sciences:

- SARS;
- radon and housing design;
- obesity;
- BSE/CJD;
- socioeconomic and other inequalities in health;
- HIV/AIDS;
- the health effects of organic or GM foods;
- water fluoridation;
- intergenerational effects of radiation upon cancer incidence;
- prostate cancer screening;
- the health effects of mobile telephones;
- possible adverse effects of childhood vaccination.

The public profile of public health sciences research creates particular problems and carries particular responsibilities. The health of the public is a topic of universal interest, is at the heart of government policy, is discussed universally in public and private debates and the findings of the public health sciences are given prominence in all news media. This enthusiasm for public health is highly desirable, but the levels of engagement and debate are not optimal.

The public health sciences may at times be central to public policy, in that findings can be used to render otherwise controversial issues uncontroversial. At other times science may be an unwelcome impediment to policy, and be ignored or discredited. A number of drivers of ill-health would require unusual political determination, for example in relation to the tobacco and food industries, and in the context of employment, education and access to public services. Those working in the field may therefore find themselves at times in receipt of welcome support and funding and at other times find their work unsupported, ignored or discredited.

Because of the immediacy of the impact of public health sciences research findings, special care is needed in communicating the results so that the public, politicians and the media do not respond with imbalanced assessments of risk. At present, some risks are exaggerated, some minimized and contradictions are common.

The fact that so many reported research findings are patently inconsistent serves to foster scepticism about risks that are preventable and allow space for claims that are scientifically spurious and potentially dangerous. The media often treat competing claims as if they are scientifically equal.

Public health scientists, public policy makers, the media and funders all have a part to play in ensuring accurate portrayals of research results and to engender an informed discussion about the results of public health science research.

Policy and practice on the management and communication of risk, and on public engagement with science generally, is often based on unevidenced assumptions or anecdotes about the public's response. For example, the Government has made assumptions such as 'the public insists on certainty', 'if we tell people that smoking or unprotected sex is potentially dangerous people will stop doing these things' and 'the public would/would not be

happy with this use of their NHS data'. It is important that such policy and practice is underpinned by high-quality empirical research which helps develop a better understanding of how different publics (including professionals) understand and engage with public health and epidemiological issues.

5.2 Importance of evidence base and limits to experimentation

Public health policies must be introduced in ways that make them capable of evaluation. Despite government rhetoric about evidence-based policy-making, it is often the case that policies are introduced in ways that make them impossible to evaluate. Policy makers and health practitioners should collaborate with academic public health scientists to ensure a rigorous framework for the evaluation of the cost-effectiveness of interventions. Public health interventions can now be designed to allow randomized or non-randomized evaluation of their cost-effectiveness. The fact that randomization may not be possible in certain circumstances, for example, in studying the effects of smoking, should not prevent studies going ahead where the observational evidence that an intervention is necessary is overwhelming.

5.3 The importance of reporting all research findings

At the heart of the public health science research process is the need to distinguish true and causative associations from those that arise from chance, bias and confounding. The failure to publish and report negative findings (which is driven by funding, scientific publishing and media considerations) accentuate positive research findings. The unrepresentative nature of many positive findings in public health science results in a flawed research record, the accumulation of non-replicated findings, the duplication of research and a misleading picture being conveyed to the public. Researchers, public policy makers and commercial and non-commercial funders must recognize the responsibility to release all research findings for the public record, whether negative or positive.

Some progress is being made in the area of clinical trials, where registration of trials is becoming an obligation and the systematic review of previous work is now a necessary prelude to further trials. Similar measures must be taken in observational epidemiology (including genetic epidemiology) and in public health interventions. Open access publishing may facilitate the introduction of systems approaches to dealing with this issue.

Conclusion

The need to place far greater emphasis in healthcare on the prevention of illness and the promotion of good health rather than focusing predominantly on treating ill-health has been starkly highlighted by the Wanless reports and the Government is to publish a White Paper on Public Health in the summer.

Public health policy and practice has to be underpinned by academic research through measures to design, conduct and evaluate public health interventions to improve public health in the UK in the most beneficial and cost-effective way.

Given the enormously increased expectations of public health, greater investment in the public health sciences is now crucial if this opportunity is not to be missed.

ANNEX 1

Members of the Public Health Sciences Working Group

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Eleanor Boddington (Secretary)	Executive Assistant to the Director of the Wellcome Trust

ANNEX 2

List of acronyms and abbreviations used in this report

AIDS	Acquired Immunodeficiency Syndrome
ASPH	American Association of Schools of Public Health
BSE	Bovine Spongiform Encephalopathy
CJD	Creutzfeldt-Jakob Disease
CSA	Common Services Agency
CSO	Chief Scientist Office of the Scottish Executive Health Department
DTI	Department of Trade and Industry
ECDC	European Centre for Disease Prevention and Control
GM	Genetically Modified
HIV	Human Immunodeficiency Virus
HPA	Health Protection Agency
IOM	Institute of Medicine
MRC	Medical Research Council
NCRI	National Cancer Research Institute
NHS	National Health Service
PCTs	Primary Care Trusts
PhD	Doctor of Philosophy
R&D	Research and Development
SARS	Severe Acute Respiratory Syndrome
SCIEH	Scottish Centre for Infection and Environmental Health
TB	Tuberculosis

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