Genetics and Health Economics

Report of a workshop organised by the Public Health Genetics Unit on 27 April 2001

1. Introduction

Recent advances in the understanding of how genetic factors contribute to disease susceptibility, the progression of disease, and responses to treatment, pose new challenges for health services. The underlying DNA defects responsible for many rare single-gene diseases have been pinpointed, and DNA-based diagnostic and predictive tests have been developed. Progress is now being made in identifying some of the normal DNA variants ("polymorphisms") that, together with environmental and lifestyle factors, determine susceptibility to common illnesses such as cardiovascular disease, diabetes and cancer. Information stemming from the Human Genome Project seems certain to accelerate discovery in this area.

Genetic scientists are pushing back the boundaries of what is possible, but there are many other factors that must be taken into account before scientific discoveries can be translated into service intervention. Not least among these are the economic consequences. For example, what are the costs of implementing genetic testing services for an increasing number of rare single-gene diseases? What are the potential costs of new genetically-based technologies such as gene therapy? How might the introduction of tests for genetic predisposition to disease perturb current patterns of expenditure on prevention and treatment? What will be the balance between costs and benefits? The area of genetics that is arguably the closest to service implementation is that of pharmacogenetics: the tailoring of drug therapy to the individual by testing for DNA variants that affect the safety and efficacy of different drugs. Under what circumstances will pharmacogenetic testing be cost-effective and how will it affect the pricing of drugs?

It was with such questions in mind that a one-day workshop was convened to discuss the health-economic consequences of advances in genetic science. The workshop, which brought together health economists, geneticists, health policy analysts, public health professionals and members of the Human Genetics Commission, had two main objectives:

1. To identify the priorities for research on genetics and health economics as applied to the NHS

2. To recommend ways of expanding research capacity in this area.

2. The published research background

The need for more research on the health-economic implications of genetics was highlighted by a literature survey presented by Ann Raven. The aim of the survey was to identify publications from the last 20 years reporting economic evaluations of genetic services and technologies in healthcare. A search encompassing Medline, EMBASE, the HEED and EED economics databases, and the "grey literature" published by government bodies and other groups, yielded, from a total of about 1400 papers, only 112 whose abstracts indicated that they provided useful, quantitative information (see bibliography). Topics covered by these papers included genetic service provision, genetic testing or screening for specific diseases, pharmacogenetics, health policy, and a "miscellaneous" category including actuarial models for insurance, analyses of willingness to pay for genetic services, ethical issues, and methodological papers. The types of studies on these topics were predominantly investigations of cost effectiveness, or straightforward cost analyses. There were few attempts to determine cost/benefit relationships or cost

consequences. Although recent years have seen an increase in the number of economic evaluations of genetic services and technologies, particularly in the area of pharmacogenetics, much of the published work is somewhat superficial and little attention has been paid to strategic issues such as the economic impact of genetics on health service organisation and budget planning.

3. The potential effects of genetics on health services

Simon Harding stressed the many questions that developments in genetics pose for the health economist. These developments fall into four main areas - risk testing, pharmacogenetics, the development of new drugs, and new therapies - all of which have uncertain implications for the demand and supply of health care services. The consequences of the development of genetic tests indicating an individual's risk of disease are difficult to predict. The level of demand for such tests is so far unknown, as are their lifetime consequences: will they lead to more effective prevention and a healthier population, or will they merely prolong the survival of a larger number of chronically ill people who will need continuing treatment? In the area of pharmacogenetics, the health benefits of better targeted treatment are clear, but if better targeting means that a wider range of drugs becomes cost effective, overall expenditure on drugs could spiral upwards. Similarly, new drugs developed as a result of genomic technology, and new "genetic" treatments such as gene therapy, could increase the demand for treatment and thereby push up costs.

How should Government respond to the economic challenges posed by genetics? There may be a need to consider the optimum ratio of public/private involvement in both the provision and the financing of health services. Government will also need to strike the right balance between encouraging research and development by the pharmaceutical and biotech industries, and protecting the public interest by regulating to ensure that safe, high-quality products are available at affordable prices. In the NHS itself, both overall capacity and service configuration will need to be considered, and provision will have to be made for genetics education and training of health professionals.

The questions for the health service translate into several questions for health economics research: are current research methodologies adequate or do we need new approaches? What sort of data will we need and should we plan now to collect it? And perhaps most importantly, what are the priorities: which aspects of genetics pose problems that are both new and urgent, and which ones can be dealt with effectively by a "wait and see" approach?

4. Economic evaluation of pharmacogenetics

Much has been made of the potential of pharmacogenetics to enhance the effectiveness of drug therapy for the individual while minimising adverse drug reactions. However, as Adrian Towse pointed out with the help of worked examples, the economic case for pharmacogenetic testing has to be made individually for each test/drug combination. In each case, the interests of the payer in achieving the maximum social benefit for the cost paid must be balanced against the need of the pharmaceutical industry to recoup its R&D expenditure and make an acceptable profit from a smaller market.

Towse and colleagues have developed equations that enable a pharmacogenetic test/drug combination to be evaluated economically over a range of conditions and assumptions. Variables that must be considered include the price of the test, the prices of the drug with and without testing, the effectiveness of the drug in quality adjusted life years (QALYs),

the size of the patient population, the ratio of responders to non-responders, and the costs of adverse reactions. In qualitative terms, the payer is (theoretically) likely to favour testing and tolerate an increase in drug price if the test is inexpensive, the proportion of non-responders is high and/or the adverse reactions are serious. In practice, however, payers may be resistant to price increases. In addition, the market for some narrowly targeted drugs may be too small to be economically viable for the drug company unless subsidies are available for orphan drug development. Pharmaceutical companies will only embrace pharmacogenetics if there are incentives for them to do so or if they are forced to respond to pharmacogenetic tests developed by the diagnostics industry.

5. The socioeconomic implications of genetics

Genetic services and interventions have social and psychological dimensions that need to be taken into account in assessing their costs and benefits. Garry Barton outlined some of the intangible, but important, factors associated with genetic testing, such as the value of knowledge provision, and the dangers of fatalism, depression or over-optimism. Do we have adequate ways of evaluating such social benefits and costs, or are new tools needed? People's psychological and behavioural reactions to genetic information may have an impact beyond the individual, affecting both the demand for services and their effectiveness. For example, those found to be genetically at low risk of an illness may be unwilling to forego surveillance that is offered to others, while the lure of genetic tests offered over the Internet may leave the NHS having to deal with a burden of distress and confusion.

The family implications of genetics also need to be considered in economic analyses, but it is not always clear how best to do this: should effects on the proband and his/her family be considered separately or together, and how can the value of genetic information to different generations of a family be estimated? If genetic testing reveals new groups of people who are significantly disadvantaged by their genetic make-up, we may need, in the interests of equity, to develop different criteria for assessing the cost-effectiveness of treatments for these groups.

6. Workshops

What are the priorities for health economic research relating to genetics and the NHS?

- *Research methodology*: Health economic research can be divided into two categories: methodological research, and research on specific topics. There was a general consensus that many of the economic issues raised by genetics are not unique to this field and are amenable to analysis by existing methods. The exceptions may be the questions of how to put a value on intangible factors such as information and informed choice, and how to take into account the family dimension of genetics. There may be a need to develop ways of integrating both "concrete" and intangible factors into the overall analysis.

- *Identifying priorities*: The two workshop groups differed in their views on how to draw up a list of priorities for health economic research in genetics. While one group recommended developing a "prioritisation template", assigning priorities to topics on the basis of the seriousness of the consequences if decisions are avoided or wrong decisions made, the other group felt that health economists needed to respond to priorities specified by the NHS on the basis of its long-term aims.

- *Data collection*: Both groups agreed that there is a serious lack of quantitative data for use in research studies. There is a need for systematic collection of data, for example on the numbers, types, costs and outcomes of genetic tests, and of defined data sets needed for specific types of research. Pharmacogenetics may be the first area in which the impact of genetics will be felt in the mainstream health service. The type of analysis described by Adrian Towse will be essential for evaluating specific test/intervention combinations but it can only be done if the appropriate data are available. A first task could be to draw up specifications for the minimum data sets required for this and other types of modelling and analysis.

- *Pilot studies*: Genetic testing for whatever indication is not an end in itself but must be considered in the wider context of service provision. The best way to approach the question of the impact of genetics at the service level would be to choose a few "pilot" diseases as examples and investigate the potential effect of genetic testing and other new genetic technologies on the delivery and organisation of services for that disease. The analysis should not be confined to the rare single-gene diseases but should include common diseases that have a genetic component, for example coronary heart disease, rheumatoid arthritis and multiple sclerosis.

- *Health-economic assessment of specialist genetic services*: The impact of genetics on service provision for a wide range of diseases raises the question of the place of the specialist genetic services (both clinical and laboratory) in the health service of the future. In order to inform this debate, it would be useful to evaluate the efficiency and effectiveness of current specialist genetic services, particularly laboratory services: what is the optimum size and number of laboratories, and is there a case for contracting out some tests to private providers?

What processes are needed to expand health economics capacity in the field of genetics and health?

- *Attracting and retaining health economists in the public sector*: There is a general shortage of health economists in the public sector. Recruitment onto training courses is difficult, and many of those who gain qualifications are then lost to the private sector where salaries are higher. If the situation is to be improved, the Department of Health and the NHS need to be prepared to invest more resources in this area. In addition, a "hearts and minds" approach is needed at undergraduate level to make students more aware of the discipline, and there may be a case for attempting to attract post-graduate level researchers from other disciplines to train as health economists.

- *Multidisciplinary training courses*: As well as an overall shortage of people, there is also a shortage of health economists working in the area of genetics. There are currently about 200 health economists in the public sector; an additional 10-20 people working specifically on genetics would be able to make a significant impact. At the training level, specialised Masters' courses could be set up and the curricula of existing courses could be strengthened. The skills and knowledge that are needed are multidisciplinary, pointing to the need for training and research alliances across the fields of epidemiology, economics and health policy research. It is unclear at present what resources might be called upon to fund new training programmes. Regional R&D funds (Department of Health) support existing Masters' programmes.

- *Centres of excellence*: Any researchers attracted into health economics need incentives to stay there. The discipline of health economics needs a higher profile in its own right in the research world. Arguably, every piece of research on health service policy or

provision should benefit from input from a health economist. However, the Research Assessment Exercise does not reward health economists who participate in a supporting role in others' research projects, and so discourages them from contributing their expertise. High-profile "centres of excellence" in health economics might help to attract able people and provide a stimulating working environment, and funding for specific research projects is also needed.

- *Potential sources of research funding*: Joint MRC/ESRC fellowships in health economics already exist, and some of these could be earmarked for genetics. The ESRC has recently announced its intention to spend £5 million on genetics-related research; economic aspects do not yet figure on its agenda but those running the programme should be encouraged to consider them. The Wellcome Trust has identified health service research as one of its priorities and might be receptive to the idea of setting up a genetics and health economics programme.

7. The way forward

The workshop participants were in no doubt that it is essential to expand research on the health-economic consequences of advances in genetic science. Several action points were agreed:

1. Research-funding bodies, such as those identified by the workshop discussion, should be approached and presented with the arguments for supporting research on genetics and health economics.

2. The report of this workshop should be circulated to key figures in the Department of Health and the NHS Executive, with the suggestion that they consider genetics and health economics as a priority area for R&D funding.

3. Groups currently involved in the organisation, commissioning and funding of genetic services, in particular the Genetics Commissioning Advisory Group and the Regional Specialist Commissioning Groups, should be apprised of the workshop's recommendations.

4. Advisory groups in the area of genetics, in particular the Human Genetics Commission, should be encouraged to flag economics as an important area for consideration.

5. Steps should be taken to enhance the profile of genetics amongst health economics researchers and to highlight the major issues. The Health Economics Study Group (HESG) would be an appropriate forum for this discussion. The papers presented at the workshop by Ann Raven and Adrian Towse could be modified for presentation to the HESG.

6. The workshop should re-convene in 12-18 months' time to assess progress.

Participants

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