

Foresight

Infectious Diseases: preparing for the future

OFFICE OF SCIENCE AND INNOVATION

**D4.3: Cultural and Governance
Influence on Detection,
Identification and Monitoring
of Human Disease**

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1 Introduction

Improvements in the detection, surveillance, management, prevention and control of infectious diseases will depend not just on technological advances but on a wide range of behavioural and other societal factors, the existence of appropriate health delivery systems and sound governance. The political will to act collectively in a global environment will be critical. Successful Detection, Identification and Monitoring (DIM) efforts depend on a reliable interface between local and global measures. They necessitate action ranging from adherence to international regulations to the support of front line health workers. Of particular importance is the ability to respond in extreme situations, such as under conditions of civil war and displacement of populations, when the ability to diagnose infections and operate surveillance becomes severely restricted. DIM efforts also face severe challenges in poor countries that have weak public health and health service infrastructures and cannot afford access to new technologies.

The requirements for effective DIM include: a good, open working relationship between clinicians, microbiologists and public health staff; a laboratory capacity to detect and characterise the infectious agent; a robust surveillance system and a responsive epidemiological service to identify and investigate unusual patterns of disease in a timely manner. Increasingly, cooperation between agencies dealing with animal and human health is critical. Technical cooperation and information sharing between organisational tiers within countries is vital for timely detection and response to epidemics. Similarly, at the international level there is a need for rapid exchange of information between countries and with appropriate international agencies such as the World Health Organization (WHO). Increased international collaboration is essential to address the global health challenges resulting from diseases such as HIV/AIDS, malaria, tuberculosis and other infectious diseases of poverty. Countries have recognised that increasing economic interdependence has made them more vulnerable to infectious disease threats beyond their borders. There is also a realisation that globalisation presents new opportunities to tackle the problems. This has also led to discussions on how to better include the private sector and non-governmental agencies in the global response.

Globally, there have been some remarkable public health achievements in controlling infection, particularly in the field of vaccine preventable disease. Nevertheless, despite enormous efforts by WHO, along with other international agencies, governments and their international development departments such as the UK's Department for International Development (DfID), other donors and non-governmental organisations (NGOs), progress has been depressingly inadequate in other areas. Major threats to human health, such as HIV/AIDS, malaria and tuberculosis, have been targeted, but success has been limited and patchy. Failure to meet goals in a number of high profile areas has led some to call for new approaches to global health governance (WHO 2002, Kickbusch 2005). The current structures and alternative ways of working at global level are explored below. In the final part

of this paper three disease scenarios are considered in order to identify some of the most significant influences at national and regional level in Africa, China and the United Kingdom.

2 The interface between globalisation and health

2.1 A shift in perspective

A groundbreaking shift in perception of health challenges and their resolution has been underway for the last decade. There is now a common understanding that we will not be able to resolve the health problems of the 21st century by relying solely on the institutional, international mechanisms developed after World War II. Nor are the public health approaches developed over a century ago sufficient to address the threats societies face from infectious disease (Kickbusch 2003; Beaglehole et al 1999, Arhin-Tenkorang et al 2003). The term *global health* has been introduced to signify a new era of public health which deals both with the interface between globalisation and population health and the significant ramifications for health governance that have emerged in consequence. 'Good governance for health' is critical if we are to fight the global threat of infectious disease and to provide one of the most important components of Human Security (Chen et al 2003).

2.2 Globalisation impacts health

In order to propose mechanisms for global health governance we need to gain better insight into the highly dynamic interrelationship between health, health policy and the major processes of global restructuring (Buzan 2004, Buse et al 2002). Risks in the 21st century are transnational, and all attempts to control them guide us into the new global arena (Jamison et al 1998). However, this must not lead us to think that 'the global' is *out there*, far away. Rather, global risk production is localised through the 'globalisation' of everyday life. Our way of life and daily security depend on a well functioning, global system (Beck 1999, Scholte 2001).

Initially, the focus of global health analysis was to understand better the impact of the myriad rapid social, economic and political changes – such as trade, travel, migration, and communication – on the health of populations. Lee (2002) has described these as the temporal, spatial and cognitive dimensions of global health.

Two aspects emerged as particularly prominent:

- The growing health gap between rich and poor countries, which is still mainly due to poverty and the high mortality from infectious diseases. Note, for example, the difference in life expectancy between Somalia and Japan of more than 40 years (WHO 1995).
- The potential threat to the rich countries through a resurgence of infectious disease, prompted initially by the HIV/AIDS epidemic and reinforced

through a number of other outbreaks ranging from plague, to West Nile fever, SARS and avian flu (WHO 1999).

Both these aspects have led to successful political mobilisation, albeit of a very different nature. On the one hand, health and human rights advocates (Global Health Watch 2005, Hofrichter 2003) and other social movements such as 'Make Poverty History' (ONE 2005) have been highly successful in putting health on the development and poverty reduction agenda and in particular in fighting for access of poor countries to vaccines, treatment and medicines. On the other hand, the rich countries moved to develop new policy approaches in order to address the growing infectious disease threat, in particular by linking global health issues to those of foreign and security policy. This began in 1997 with a ground-breaking document by the US Institute of Medicine: *America's vital interest in global health: Protecting Our People, Enhancing Our Economy, and Advancing Our International Interest*' (IOM 1997). This has since been followed by an increasing concern by governments and heads of state of the rich nations, in particular the G8 members. Following the focus on health in Africa by the British presidency, Russia has again put health on the agenda of its G8 presidency in 2006.

Finally, there is an increasing awareness in the business sector of the economic impact of global pandemics. The most recent World Economic Forum meeting at Davos 2006 organised a number of top level debates on the preparedness and response of companies with respect to the risk of a global influenza pandemic.

2.3 Health impacts globalisation

This interest by rich nations reflects the fact that global health analysis has moved on. Today, it is understood that global economic restructuring influences health and its determinants both positively and negatively. In addition, it might be of even greater importance that the health status of populations can be a factor determining the economic development of poor and rich nations alike. Disease outbreaks and global pandemics of both infectious and non-infectious disease can have significant negative economic impact, locally and globally. The Commission on Macro Economics and Health in its report of 2001 (Commission 2001) and the Report of the UN Millennium Project in 2005 (UN Millennium Project 2005) have both forcefully made the point that investment in the health of populations might be one of the most influential factors on the economic development of poor countries. Health expenditures wipe out private household income and assets, and sick populations significantly reduce overall productivity.

Accordingly, the Millennium Development Goals (UN Millennium Declaration 2000), with their focus on poverty reduction, have given high priority to health. Three of the eight goals directly address health issues, and one of these explicitly focuses on reducing infectious diseases, in particular HIV/AIDS, tuberculosis and malaria.

In parallel, in the rich countries, awareness has increased that, in ageing societies, good health is critical for wealth and quality of life (EU report 2005).

In addition, recent global disease outbreaks have shown a significant direct and indirect economic impact on developed countries and the global business community. An analysis of the impact of the SARS epidemic on the city of Toronto (Sloan Foundation 2005) calculated 12,000 lost jobs and a cost to the Toronto economy of over \$1 billion in 2003 alone. The costs of SARS to the east and southeast Asian economies as a whole are estimated at US\$ 18 billion in nominal GDP terms for 2003, which means about US\$2 million per person infected. The total expenditure loss is put at close to US\$60 billion or US\$6 million per infected person. (Asian Development Outlook 2003.) A human pandemic of influenza from a new virulent virus strain, perhaps derived from H5N1 avian flu, could cost the world more than US\$800 billion in economic loss, along with many millions of deaths. It has therefore been accepted as critical that rich countries invest in enhancing their preparedness both at home and abroad.

2.4 Globalisation cannot afford to neglect health

The consequence of the above is that neither rich nor poor countries can afford to neglect health, be this for ethical, economic, political or security reasons. We now live in a global risk society (Beck 1999) in which increased interdependence blurs not only national borders but also the dividing line between domestic and foreign policy, between health and other policies, between medical intervention and consumer protection, and between state and non-state actors. No longer is the poor shape of public health measures an issue purely of national sovereignty. It can lead to a trans-border or global disease threat.

Therefore, weak public health systems in one country are of legitimate interest to the whole global community. No longer can a well organised and funded national public health system alone ensure the health of its citizens. Rather, a global governance approach to health is required to contain risks outside the reach of such a national system, indeed outside the reach of governments, including the determinants of health. No longer is security achieved in a balance of great powers and grand strategies, but in containing risk at the weakest link. Indeed, we must live with increased uncertainty in health. No longer can business remain disengaged from the development of global health strategies. Reliable DIM is as important as never before.

3 Dimensions of global health governance

3.1 Global Health

Global health, according to the much-quoted definition by the US Institute of Medicine: 'addresses those health problems, issues and concerns that transcend national boundaries, may be influenced by circumstances or experiences in other countries, and are best addressed by co-operative actions and solutions' (IOM 1997). But, despite this acknowledgement of the global health challenge, what we find is a lack of long term commitment at national and international level to:

- construct and maintain strong public health systems;
- strengthen human resources and scientific capacity-building for health;
- ensure sustainable financing;
- invest in the production and sharing of knowledge and technology.

The recent disease outbreaks throughout the world, as well as concerns over potential pandemics, have drawn our attention to how weak the institutional and organisational base is for addressing global health risks. This shortcoming is particularly serious when health concerns call for cooperation and action across borders and in other policy arenas. For example, the link between human disease surveillance and the surveillance of animal and zoonotic diseases leaves much to be desired. The weaknesses in both surveillance and response capacity in rich and poor countries have underlined yet again the critical role of open information sharing and communication (Zacher 1999).

However, the enormous capacities available worldwide for research and development, for communication and information, for networking and knowledge-exchange have not been mustered sufficiently to share solutions (Stiglitz 1999; Freeman and Miller 2001; Global Forum on Health Research 2000). We still have a long way to go to ensure that the knowledge and technologies we have are applied in order to prepare rich and poor countries alike for the unknown – such as a potential global flu pandemic or a disease yet to be identified. The rhetoric accepts that risks in the 21st century are transnational. Yet the lack of consensus on investing in surveillance infrastructures in poor countries and the great reluctance to loosen patent laws in the face of a global threat – documented, for example, at the recent Canadian conference on avian influenza (October 2005) – speak another language. The World Economic Forum report on ‘Global Risks 2006’ states: ‘Our collective ability to mitigate global risks is still seriously hampered by: divergent perception of the nature and importance of such risks; differing agendas; and the inability of any government, business or international institution to address these risks independently.’ (WEF 2006).

In fact, it can be argued that the present state of affairs is best described not as a ‘disease crisis’ but as a ‘crisis of health governance’ (Garret 2000; Kickbusch 2004). The critical step needs to be taken at a political level, from the *recognition* of mutual vulnerability from disease and the mutual gain from good health, to the *acceptance* of health as a global public good. All global players, and in particular nation states, need to act forcefully to put in place health governance mechanisms that ensure the production paths that such a global and transnational public good requires (Kaul et al 1999, Kaul et al 2003).

3.2 What is governance?

Governance can be understood as ‘organised efforts to exercise power to achieve ends’. All debates about ‘good governance’, therefore, need to

include a discussion on the means, the ends and the distribution of power, and how these three elements - ethical, technical and political - interface to produce results. 'Good governance' is critical for generating and applying knowledge to fight infectious disease. Increasingly, it is understood that governance is not restricted to governments, but involves a wide range of players. This understanding of governance links easily to the definition of public health as: 'the science and art of preventing disease, prolonging life and promoting health through the organised efforts and informed choices of society, organisations, public and private, communities and individuals' proposed by the recent report on 'Securing good health for the whole population' (Wanless 2004).

A 'good' global health governance system (Kempa, Shearing, Burris 2005) would therefore be concerned with:

- delivering results (efficiency and effectiveness;)
- ensuring that the results delivered are deemed good (fair, reducing poverty, increasing equity);
- addressing the distribution of power, through increased participation and spaces for interaction of all players.

It is crystal clear that the present system does not fulfil these criteria.

Of course, health is not alone in facing new governance challenges. 'The global challenge' has become the norm in practically all policy arenas including economic policy and trade, the environment and climate change, migration, crime and terrorism. (Spencer 2005, WEF 2006) All are in need of approaches that:

- create a level playing field between countries;
- engage a broad group of stakeholders;
- focus on prevention in order to contain transnational risks;
- organise the interface between national and transnational policy responses.

3.3 Global health governance needs to deliver global and transnational public goods

Health - including the risk associated with infectious disease - is perhaps the area of policy in which the combination of a scientific evidence base, the fear of infection by citizens, the outrage at inequity by activists, and the pressure for change from a wide range of actors is presently most potent. This can be shaped into a new system of foresight, responsibility and accountability that protects us all. Such a system would have obvious, wide-reaching benefits and significant cost spill-overs to the global community. Sandler and Arce (2001) have provided a helpful and clear description of the properties of

transnational and global health-promoting public goods along three essential dimensions:

- Non-rivalry, for which the confirmation of the benefits of an activity in one nation does not, in any way, preclude other nations from partaking in the good's benefits. Since the eradication of smallpox in 1977, people no longer need to be vaccinated, thus conferring a non-rival health benefit worldwide;
- Non-excludability, for which the provider of the good cannot prohibit its use by others. Knowledge of best treatment practices fits this description.
- The technology of public supply aggregation, which refers to the manner in which overall contributions are combined to create a public good.

A clearer understanding of which part of global health activities have public good properties helps identify not only *which* public policies are needed, but also *who* should initiate them. This is critical because the debate on global public goods frequently neglects the economic premise that the 'publicness' of a good refers to the inherent qualities of the good in question (see above) NOT to how the good is provided. In consequence, the 'publicness' properties of health-promoting activities can facilitate the design of institutional and financial arrangements and help in defining the roles that various agents can play in leading, coordinating, and delivering on the promise of global public health. Sandler and Arce (2001) have attempted such a taxonomy (see Appendix) which could be further elaborated in a next step in order to define action priorities for the response to global infectious disease threats. At the same time, it is clear that, because the under-provision of many public goods relates to lack of cooperation and to market failure, political will and a 'public' push – for example from non-governmental organisations – are critical.

3.4 The growth of 'unstructured plurality'

In order to locate entry points for 'good' global governance for health, which produces global and transnational public goods - in our case reduces transnational disease risks - we need to gain a better understanding of the present institutional architecture and the current constellation of interests and actors in global health. While in general international health circumscribes the purview of the representatives of nation states interacting within the defined boundaries of an international organisation such as the World Health Organization, global health has no defined centre of action and creates a new political space (Kickbusch 2003). It is characterised by a growing and complex assemblage of actors interacting on a wide variety of converging and conflicting interests. This governance characteristic has been termed 'unstructured plurality' (Beck and Lau 2004). The significant growth of actors and activities in global health can, at first, overshadow the governance problems inherent in this new polycentric system (Kohlmorgen 2005). The key new players are:

- **Businesses.** In health these have become central. Health is now one of the largest private markets in the world. Industries that endanger health –

such as tobacco and alcohol – are amongst the most influential global industries, as are industries with a high relevance to health, such as the food industry. Medical and pharmaceutical research is a key area of research and technology development, and a major factor in innovation and competition between companies, regions and nations. (World Economic Forum 2005).

- **Other international agencies and groupings.** In consequence, health has become critical in the agendas of non-health organisations such as the World Trade Organization and the World Bank, as well in the deliberations of groupings such as the G8 and the World Economic Forum. In many cases, health agendas and economic growth and investment agendas compete rather than complement one another, and innovation is focused on the needs of the rich rather than the poor countries – as in pharmaceutical development (Labonte 2004, Ollila 2005).
- A growing number of **highly diverse new organisations, networks and alliances** focusing on discrete and measurable areas of action. These have superseded the simple division of delivery mechanisms between bilateral and multilateral health agencies. For example, new organisations such as the Global Fund on AIDS, Tuberculosis and Malaria and UNAIDS have been established to address priority problems. Also, a growing number of public private partnerships such as the Global Alliance on Vaccines and Immunization (GAVI) are engaged in reducing the infectious disease burden in the poorest countries. While these bodies have shown partial success based on their adherence to new public management, they reach their limits of action as they all compete for the same set of financial resources which still mostly reside in the overseas development budgets of nation states. Frequently, their stipulated conditions put additional burdens on the receiving countries. (Richter 2005),
- A **set of strong new non-state players** is defining priorities and approaches. As global communication becomes easier and cheaper, the role of non-governmental organisations has become much more prominent both in setting agendas and in delivering services, for example Médecins sans Frontières or CARE. Foundations have gained high influence as new major players in setting agendas through their resource-based power in global health. The Bill and Melinda Gates Foundation in particular spends about US\$1 billion on global health annually. An increasing number of global health initiatives – also within WHO – are dependent on support by this foundation. The pharmaceutical industry and other parts of the private sector are increasingly involved in not-for-profit activities and alliances to improve health in rich and poor countries. (Stansfield 2002, Hilts 2005)
- **Regional organisations** such as the European Union, ASEAN, OAS and the OECD. These have significantly strengthened their health portfolio and on the other end of the spectrum municipal actors are engaging in worldwide cooperation to address local problems.

3.5 The limits of unstructured plurality

These new players interface in many ways with existing infrastructures such as national bodies - the various national centres for disease control, for example - many of which also play a global role. They also link with academic centres which conduct large scale global health interventions, and many international organisations. But it is evident from this short description that:

- the 'monopoly' of nation states in the international health arena is being challenged - but not replaced - through a multi actor/polycentric global health system;
- the role of both national governments and international organisations needs to be reconsidered and redefined in this radically new context.

This is all the more important as, after the initial euphoria over the rapid expansion of global health initiatives, the flip side of this pluralism of actors and approaches is becoming more evident. Indeed, the main argument for new types of governance mechanisms (such as public-private-partnerships, global funds, alliances) was to:

- provide better results (in particular more efficiency and effectiveness) than the international state-based system (i.e. the United Nations organisations);
- be driven by technical agendas not the political contingencies of the state-based decision making processes;
- be more inclusive by involving a wide range of stakeholders, in particular the private sector.

There is now a growing sense of concern with the redirection of global health functions from interstate mechanisms to this polycentric group of actors. Greater efficiency (defined as reduced transaction costs) and even significant success (Levine 2004) might have been achieved for individual diseases, projects and separate parts of the system. Overall, however, contemporary health governance is now faced with fresh challenges emerging from the new constellations, namely:

- fragmentation and competition;
- lack of transparency and accountability;
- a significant disparity in power between rich and poor countries as well as between strong and weak players.

For example, with few exceptions, no significant breakthrough has been achieved in the global fight against HIV/AIDS. The world now faces the threat of a major epidemic in central and eastern Europe and the countries of the former Soviet Union, as well as in China and India. In fact, many of the 'seven deadly sins' (Birdsall 2004) of donor behaviour are replicated in the 'new'

health governance, not least because, in many cases, the key players have simply changed hats not perspective.

In consequence, global health governance is faced with a double dilemma. Going back to the old way of doing things based primarily on national governments and international organisations is clearly undesirable (and of course impossible). But the polycentric system as it works at present is also not sufficient to address the pressing global and transnational health challenges both in rich and poor countries. If even the most successful and evidence-based programmes are not sufficiently scaled up to reach most populations at risk (Levine 2004) then the global health challenges and the threat of infectious disease must be approached from another intellectual, political and organisational premise. This insight is best expressed by Inge Kaul, in her seminal work on global public goods: 'the pervasiveness of today's crises suggests that they might all suffer from a common cause, such as a common flaw in policy making, rather than from issue specific problems. If so, issue-specific responses, typical to date, would be insufficient – allowing global crises to persist and even multiply. (Kaul et al 1999).

4 Exploring a global public goods approach based on tripartite governance

4.1 Learning from the transition phase

It is best to consider the present phase of global health governance as a transition phase that can provide helpful insights for creating a deeper systems reform to ensure health as a global and transnational public good. Indeed, the most positive aspect of the present phase of unstructured plurality (Beck and Lau 2004) - where anything goes - is that it clearly shows how much can be done outside state and international organisations by other, highly motivated actors, and how important these are in moving forward the global health agenda. This pluralist and polycentric system of global health will continue in any event, and many of its proponents can be mustered as allies to build a global public goods approach to health, based on tripartite governance. Indeed the many types of cooperation that have emerged make an excellent base from which to move forward collectively.

The infectious diseases DIM area is, without doubt, the most promising domain of global health governance in which to move forward with a global public goods (GPG) approach. However, as the WHO Framework Convention on Tobacco Control (2005) demonstrates, this is by no means the only one. Indeed, while economists argue that 'publicness' of a good is related to its inherent properties (Sandler and Arce 2002), political scientists maintain that it is a policy choice. In infectious disease control both schools of thought can be complementary.

It can well be argued that a reliable global health governance system that ensures DIM will provide significant benefits at the local, national, regional and international levels, and for future generations following the three dimensions of non-rivalry, non-excludability and the technology of public supply

aggregation. But, without the political agreement to invest in the production of global and transnational global public goods, no amount of definitional clarity will help. This implies that the state-based system – nation states and international organisations – must accept not only a central role in ensuring good global governance, but also involve other stakeholders.

The experiences of the recent SARS and avian flu outbreaks have highlighted the weaknesses of the present polycentric system. When confronted with a major disease outbreak, such as SARS or avian flu, or a global pandemic, such as HIV/AIDS, nation states cannot abdicate their global health responsibilities and proceed to weaken the very international bodies that provide the platform for collective action in the face of an increasing transnational disease threat. A reliable, well-funded and highly competent global health governance system must be put in place. It is the role of the public sector to assume leadership in order to ensure the health and wellbeing of their citizens and the global community at large. Such a system must address two key mechanisms of governance:

- binding countries through treaties and regulations which define their responsibilities towards their own national constituency and the global community;
- binding and making accountable other global actors through appropriate additional regimes.

Two critical steps have been made in this direction, one from a non-health and one from a health player, and both involving nation states under very different rationales. World Trade Organization Member States must comply with the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) that deals with cross-border transmission of infectious diseases. Here, the biggest area of concern is the international spread of food-borne pathogens. WTO Member States must comply with the SPS Agreement in applying trade-restricting measures to protect themselves from the importation of food-borne diseases, and these, in turn, must be based on international standards promulgated by relevant international organisations.

Of greatest importance is that there is a dispute mechanism. Disputes under the SPS Agreement are settled through the WTO's Dispute Settlement Understanding.

The second big step has been taken by adopting the new WHO International Health Regulations – (IHR2005). It is clear that only the sense of urgency in the wake of the recent outbreaks of SARS and avian flu made these regulations possible in their present form, despite earlier unwillingness by countries to pool sovereignty and provide transparency and accountability (Fidler 2001). The renewed mandate given to Member States and WHO under the IHR(2005) has increased their respective roles and responsibilities. Member States are now required to develop, strengthen and maintain core surveillance and response capacities to detect, assess, notify and report public health events to WHO and to respond to public health risks and public health emergencies. WHO, in turn, has to collaborate with Member States to

evaluate their public health capacities, facilitate technical cooperation, logistical support and the mobilisation of financial resources for building capacity in surveillance and response. The IHR now provide a 21st century code of conduct for notifying and responding to public health events of international concern, though they have yet to be fully turned into practice.

The prime challenge to all global players in the polycentric global system is to meet the timeframes and goals set in the IHR in good time. Indeed, in view of the avian influenza outbreaks throughout the world, the WHO Executive Board in January 2006 discussed voluntary compliance with the provisions of the new IHR before they come into force. The second step is to bind and involve the other global players through additional regimes and tailored approaches – or to bind the same players (i.e. nation states) under a different rationale (i.e. trade, security, human rights) within non-health systems, as with the SPS agreement.

The outcome of such efforts could, over time, be a system of tripartite governance of DIM as a global and transnational public good, mapping out clear roles and responsibilities.

4.2 Production paths for global public goods

Article 3.3 of the IHR states that: 'The implementation of these Regulations shall be guided by the goal of their universal application for the protection of all people of the world from the international spread of disease.' This reflects the political essence of a Global Public Goods approach: all countries must contribute in order for the good to emerge, from which, in turn, all countries and their citizens will benefit. A similar principle applies to transnational public goods, for example of a regional nature. But – and this can be the unique contribution of the new polycentric health system – other actors and stakeholders that benefit and that can contribute must be tied into such a system of global goods production. Sander and Arce (2001) go into great detail with regard to the different production paths. For the purpose of this paper, however, it is sufficient to highlight four different types (Kaul 2004), all of which are of high relevance to infectious disease control and open up significant opportunities for tripartite governance:

- **Summation process.** All actors, countries, firms, households and individuals would have to follow a certain behaviour in order for a particular good to emerge. Often, all actors have to make the same contribution or highly complementary efforts. The IHR are an expression of such a summation process, describing the necessary actions and responsibilities for a wide range of actors at different levels.
- **Weak-link situation.** In this case, it is also necessary for all to contribute to the good, with two differences from the previous case. First, each actor would have to make a location-specific contribution, e.g. each government would have to strengthen its national public health system, including surveillance. And, secondly, the overall availability of the good depends on the contribution of the weakest or weaker links. An example is the control

of communicable diseases, such as SARS or avian flu, which will succeed only to the extent that the 'weak' actor undertakes - and is supported in undertaking - any necessary efforts. This is the real-world situation faced by DIM and needs therefore to be the critical starting point for tripartite global health governance. Only if the weak link situation is addressed up front will the IHR be able to be fully implemented.

- **Best-shot provision.** This refers to the situation when a public good, e.g. a new scientific insight, only needs to be produced once in order to exist and enter the global stock of scientific knowledge. This approach is of course critical in relation to issues such as vaccine research or the search for HIV/AIDS treatments. The recent Grand Challenges in Global Health Initiative of the Bill and Melinda Gates Foundation approached the best-shot provision by making US\$ 650 million available for research. The funding covers the search for dried vaccines, 'Lab in a box', that is palm-sized, battery powered laboratories and new types of refrigeration for vaccines. The Foundation is also highly supportive of IAVI - the AIDS Vaccine Initiative. Other new financial mechanisms - such as the International Finance Facility - also attempt to front load best-shot provisions. These, however, should not only be seen as medical advances, but also as advancing social innovations, such as social mobilisation for health, new means of communication and the like.
- **Common-facility approach.** Economic reasons, such as economies of scale and scope, or political considerations of legitimacy and neutrality, sometimes make it desirable for individual actors to create a common facility or infrastructure, a recent example being the European Centre for Disease Prevention and Control. The actual production or maintenance of the good is, in this case, often delegated to a particular handling agent. This approach too is critical for a GPG approach to DIM as surveillance, monitoring and rapid response need to be ensured in an environment where countries have very different levels of support at their disposal and the UN system has no resources for their regular upkeep. It is quite possible that such facilities are one step removed from the international institutions - and run independently - with a strong system of oversight by the international community and special oversight bodies.

4.3 Involving the polycentric system

A global public goods approach to DIM does not stand in opposition to the existing polycentric/multi-actor system of global health governance. On the contrary, the four approaches classified above can help to clarify priorities for investment and involvement - for example a common facilities approach to support surveillance in sub-Saharan Africa - and the contributions of different actors to different production paths. In order to achieve the buy-in of many players, the most productive approach is to focus initially on those activities that generate joint products. These occur - as Sander and Arce (2002) point out - 'when a single activity yields two or more outputs that may vary in their degree of publicness'.

For example:

- when sharing surveillance intelligence on epidemics, the nation providing the data achieves country-specific benefits from being the first to assess a threat and by controlling what gets released. In addition, the release also generates a transnational, pure public good by helping to prepare others to reduce health risks far beyond the provider's political borders.
- by immunising its population, a country achieves a less susceptible citizenry and a smaller incidence of the disease, while lessening the risk abroad.
- another instance of a health-promoting activity with joint products is introducing orphan drug legislation, through which the host country's pharmaceutical industry prospers financially under the legislation, while LDCs benefit from the discovery of new drugs.

Once there is a political decision that delivery of a GPG has international merit, a regime would be established to co-ordinate production and consumption. Sagasti and Bezanson (2001) suggest that, in a fractured global order, all components of a GPG exist in one of 3 domains: global, local, and via networks

Indeed, the essential governance challenge would be - when considering production, delivery and consumption of a GPG of DIM - to establish regimes or multi-actor commissions with specific mandates for each of these domains (Rogers, 1993). A global health treaty – such as the IHR – would then be supplemented by a set of regimes 'created by self-interested actors to solve or at least ameliorate collective action problems' (Young, 1999). Some of the new alliances, funds and initiatives in the polycentric system have been created with this kind of rationale. The SPS agreement, the CODEX ALIMENTARIUS and TRIPS are other examples.

A much more concerted and focused effort, though, is needed to address the present set of global risks and to create a greater synergy and equity within the polycentric system. Existing regimes usually reflect the self-interest of the strongest players or are based on a charity-type model of development aid rather than an equitable, participatory approach to GPG. Kaul et al (1999) identify the 'participation gap' as critical in the design of GPG regimes and their implementation, taking us back to the power dimension of 'good governance'.

4.4 Financing DIM as a global public good

It seems logical that, when there are high returns associated with a GPG - such as infectious disease control - the cost of its provision should be shared (Arhin-Tenkorang & Conceição, 2003). Political reality shows that, in many cases, there is little incentive for the different actors to do this. In the rich countries, the 'free rider' problem is much discussed while, for the developing nations, it is difficult to prioritise the supply of certain GPGs if they are seen to

be in the interest of the developed world only. Kaul (2003) has proposed that because rich nations and their citizens, as well as major transnational companies will, in the short run, be the prime beneficiaries of global action, it seems appropriate to base the financing of GPGs on the 'beneficiary pays' principle (Kaul, 2003).

This opens up possibilities of developing a summative process, in which different stakeholders in the polycentric, global health system finance different parts of the GPG provision for DIM, and do so reliably. Rules could be established for managing different forms of financial participation for different parts of the production process. Indeed in practice this is already the case. It is critical that the funding for DIM as a global and transnational public good be separated from traditional development aid and its financing mechanisms. It must be clearly identifiable as a GPG effort, even where it involves building infrastructures – i.e. laboratories for example, or surveillance stations – or capacity at the local level.

There may also be an added incentive for multi-national corporations in, for example, banking, airline travel, and tourism, to become engaged actors in global health and substantially engage in additional efforts to finance provision of the GPG. This has happened with the pharmaceutical industry in the area of HIV/AIDS drugs. Proposals have also been put forward to introduce certain types of global taxation (Enayati and Hemmazi 2002, Chen 1999, Kickbusch 2003b). In November 2005, the French government approved a tax on airline tickets to help fund development (Reuters 2005). Their rationale was that the reduced risks of doing business in a global world will lead to more security for investments, and that global businesses and citizens who depend on global security as they travel should all contribute. The IATA – the International Air Transport Association - reacted very negatively, as did a number of other EU countries. This is a good example for the argument that a clear dividing line must be drawn between financing development and financing global public goods – a distinction that was not made in the French case.

5 Global public goods and good governance

The global public goods approach for DIM is clearly related to the components of good governance as outlined above. This could be done, as indicated by some authors (Kempa, Shearing, Burris 2005), along the lines of further developing the tripartite governance of global public goods. This would involve strengthening the normative and 'steering' role of the representatives of the international organisations and national governments and creating separate service providing agencies and quasi- independent oversight bodies. All three components of 'good governance' could be significantly strengthened:

Be good at delivering results

Efficiency and effectiveness can be achieved by, for example:

- ensuring standards and norms, accountability and transparency through international health law (summation process);

- ensuring a rapid, public/private response to sudden disease outbreaks;
- ensuring the rapid sharing of new knowledge.

Ensure that the results delivered are deemed good
(fair, reducing poverty, increasing equity) by, for example:

- investing in the weakest link;
- monitoring compliance, e.g. through a watchdog agency;
- establishing the means to enforce compliance through arbitration.

Address the distribution of power,

for example, through:

- increased participation and spaces of interaction;
- partnerships and coordination of partnerships;
- strengthening innovation and increasing the opportunities to pool knowledge;
- ensuring transfer of medical and public health knowledge, technologies, and patents;
- strengthening networks.

6 Aspects of governance at country level

6.1 Informed Consent

The principle of informed consent is widely accepted internationally and has been defined as: 'A person's voluntary agreement, based upon adequate knowledge and understanding of relevant information, to participate in research or to undergo a diagnostic, therapeutic, or preventive measure.'

In giving informed consent, subjects may not waive or appear to waive any of their legal rights, or release or appear to release the investigator, the sponsor, the institution or agents thereof from liability for negligence.' (University of Virginia).

In the UK there are legal provisions that enable certain tests and routine surveillance for infectious diseases to be conducted without explicit consent (Health & Social Care Act 2001). However, these provisions are subjected to an annual review until such time as there is a full consultation with the public or a new statute is introduced. However, consent must be obtained from patients before testing for a serious infectious disease, except in rare circumstances. The information provided at the time must be appropriate to the circumstances and to the nature of the condition or conditions. Some

conditions, such as HIV infection, have serious social and financial, as well as medical, implications, so it is imperative that individuals be given appropriate information about the implications of any tests, and an appropriate time to consider and discuss them. It is questionable whether some of the newer DIM technologies, such as remote sensing and tracking, could be introduced for routine use without prior public consultation, unless under exceptional circumstances. The European Convention on Human Rights, which has been ratified by the UK, enshrines a right to respect for individual private lives and prescribes the circumstances in which it is legitimate for a public authority to interfere with the enjoyment of this right. The Human Rights Act 1998 allows UK citizens to assert their rights under the European Convention in UK courts and tribunals. It is possible that this statute may be used to challenge the introduction of controversial DIM technologies. As with other potential new technologies that may raise public concerns, government and others should engage with the public at the earliest possible stage.

6.2 Confidentiality and data protection

In many countries, the data collected on individuals by DIM systems will be subject to legislation on confidentiality and data protection. The stringency of the safeguards varies considerably from country to country. In the UK, health authorities and all other agencies are required to comply with the Data Protection Act 1998, the Health & Social Care Act 2001 and the recommendations of the Caldicott Committee (Department of Health 1997). The Data Protection Act sets standards which must be satisfied when obtaining, holding, using or disposing of personal, identifiable information. The Caldicott recommendations require that justification for the use of patient-identifiable information must be provided, that this information be kept to a minimum and that it be used only when absolutely necessary. Access to the information should be on a strict need-to-know basis. It must be borne in mind, however, that the purpose of collecting patient-identifiable information through DIM systems can be justified and indeed will be necessary to protect public health.

6.3 Health services and arrangements for prevention and control of infection

The ability in a given country to implement new DIM systems that are effective and efficient will depend to a large extent on its level of investment in health service infrastructure. There needs to be an appropriate balance between the funding of curative and preventive services, which is lacking in many countries. People working in public health or primary care may have a lower status in comparison with those working in clinical practice in secondary or tertiary care, especially those employed in private practice. This inevitably leads to difficulties in recruiting and retaining good staff, exacerbated in many developing countries by migration of the trained workforce to richer countries (Bundred, P. E. and Levitt, C. 2000). The consequence all too often is a poor quality public health service, including facilities for surveillance and control of communicable diseases. Although cultural factors may be at play, this is primarily a matter of governance and often reflects a lack of political will. Historically health ministers have usually carried much less influence than,

say, trade or foreign affairs ministers, but there are signs of change. In several developed countries, this has been brought about by public concerns over health issues and the ever-increasing proportion of GDP consumed by health services. In some developing countries, there is a growing realisation among politicians of the relationships between health, infection control (or deficiencies in it), and international trade and economic development. DIM systems for infectious diseases provide information to serve two main purposes, to enable optimal clinical care and to provide the means for prevention and control of infections. The first aim requires close collaboration between clinicians and laboratory staff. This is facilitated in some countries by medically qualified microbiologists who are based in laboratories but provide advice to clinical colleagues. In other countries, clinicians with a particular interest in infection and close links with the laboratory provide the advice. Nurses with particular responsibility for infection control may be based in laboratories or hospital wards to contribute to surveillance and provide advice.

The second aim requires a public health service, supported by legislation, to operate local and national surveillance using data from microbiology laboratories and many other sources. There are several models around the world for delivering surveillance, ranging from provision by health authorities, by local authorities, dedicated agencies or ministries of health. In England, the Health Protection Agency (HPA) operates local, regional and national surveillance. In undertaking its responsibilities in surveillance and control of infection, the HPA has to collaborate with health authorities and trusts, with local authorities, water providers, veterinary services and many other agencies and organisations. It also has to work closely with government departments, particularly the Department of Health, in managing significant outbreaks and in providing information from surveillance, outbreak investigation and research to inform national policy. Prerequisites to ensuring a smooth flow of information and advice between the many organisations that may play a part in prevention and control of infection include defined roles and responsibilities, the application of standard operational procedures and, where necessary, a legislative framework. An assessment of the influence of legal and regulatory frameworks at national, regional and international levels on preparedness planning, detection, surveillance, response and control of infection is given in Table 1. The influence of societal factors is also shown. A single cross suggests a limited influence and three crosses a prominent effect currently. Yellow shading highlights aspects most likely to be of greater importance in 10 to 20 years' time. Whilst the classification represents a subjective assessment by the authors, which may be challenged, it does provide a basis for discussion. National legislation and regulation is seen to carry much more influence currently than legal and regulatory frameworks at international or regional level, at every stage from preparedness to post-containment control. This could well change, particularly within the European Union, but also internationally in relation to preparedness planning and information sharing.

Investment in science and technology currently has a strong influence on each step, and this effect is expected to increase in the future. Societal attitudes towards managing disease via DIM as well as religious beliefs or

concerns appears to be particularly important in influencing the development of policies, preparedness planning, diagnosis, sampling and application of control measures.

7 Cultural influences

Many cultural as well as governance factors will influence the introduction of new DIM systems. Perceptions of disease will vary in different cultural settings, but may have profound effects on willingness to seek healthcare. These issues are discussed in detail elsewhere in this report (Geissler, W. and Ombongi, K. 2006). Certain infections carry stigma in many societies such that individuals will often avoid diagnostic testing. In some developing countries, there may be a reluctance to accept healthcare from individuals or agencies from outside their locality. Local beliefs, sometimes reinforced by religion, may play an important role in this and present particular difficulties to international agencies attempting to provide local DIM services. The involvement of anthropologists in addressing these complex issues could be beneficial. In many developed countries, there has been a decline of trust in government, particularly in relation to health issues and in part because of lack of openness in managing major outbreaks. In the UK, a degree of cynicism has developed around the advice and role of scientists, especially those advising government. To a great extent the fault lies with scientists themselves in the way they present their findings to the public and handle areas of disagreement. The media must carry some responsibility (Harrabin, R. Coote, A. Allen, J. 2003), however, as evidenced by the reporting in the UK on claims of side effects of MMR vaccine when the balance of the evidence and medical and scientific opinion was not adequately presented. In many developing countries, there is a deep seated lack of trust by populations in government structures as a consequence of corruption, ineffectiveness, lack of reliability and too many broken promises. The Commission for Africa Report (2005) identified the role that donors could play in strengthening national and local institutions to address these issues and broaden the participation of ordinary people in government processes. Transparency provided by accountable budgetary systems could help to combat corruption.

Whatever the basis of this lack of trust in science and government, though, there is clearly a need for greater emphasis on informing the public on the rationale for surveillance and monitoring. In introducing new DIM systems, there must be an open debate with the public on the potential benefits and harm associated with the new technologies. Tagging and tracking systems will present a particular challenge in most societies where privacy is highly valued by individuals. It is likely that some methods of data capture will be unacceptable to the public in the absence of overwhelming evidence of their value in protecting human health. Would it be acceptable to accept evidence from other countries where it had been secured without informed consent? One approach to making progress in this difficult area might be to establish bodies, independent of national governments, that could work in a transparent way towards securing public and international support. Once data has been captured, by whatever means, there may be a reluctance to share information

with other organisational tiers within the health system or with other agencies that need to know. This reluctance may be linked to deep-seated cultural factors around loss of face, concerns over possible retribution from higher authorities in authoritarian regimes, or possible impact on trade. This may lead to delays in sharing internationally data required for responding effectively to infectious disease events.

8 Comparison of the influence of cultural and governance factors in sub-Saharan Africa, China and the United Kingdom

An assessment was made of the influence of governance and social factors on the detection, identification and monitoring of infectious diseases in humans in the geographic exemplars, based mainly on three case studies. These studies of the management of selected communicable disease events in the United Kingdom, China and sub-Saharan Africa are summarised in Appendix B. The assessment is given in Table 2 in which the influence of each factor was scored in a similar way to that used in Table 1. Yellow shading again highlights aspects most likely to be of greater importance in 10 to 25 years' time. In most scenarios these aspects will have a positive effect, but some will have a negative influence. Several anticipated developments were taken into account, including implementation of the International Health Regulations that will enforce international public health governance, the strengthening of supra-national regional organisations and the potential for an increase in religious fundamentalism. It is difficult to assess sub-Saharan Africa as a whole in view of the diversity of the countries in this region, particularly as regards cultures and stages of development. . For the purpose of this Table, we have chosen the poorest countries where large proportions of the population live in rural areas. Cultural factors have the most prominent influence on DIM in developing and developed countries. As regards governance, it is anticipated that regional or other supranational groupings will have a greater impact on DIM in the future in all three exemplars. DIM interaction with control mechanisms is well developed in the UK and will become so increasingly in China and sub-Saharan Africa.

A key message from the case studies is the need to take more care than hitherto in deciding how best to promote and use new DIM technologies in different cultural and political contexts. The studies have shown deficiencies in the structures that protect the public health. In the UK, major reforms of services and central government departments have been applied to strengthen the arrangements. In China and sub-Saharan Africa, the examples illustrate the need for developing the existing public health services. This resonates with conclusions drawn in the third annual report of the Global Governance Initiative (World Economic Forum, 2006): 'The great obstacle to serious progress towards the global health goals remains the woeful state of the world's public health infrastructure. The trained personnel, medicine, equipment, physical facilities and governance systems to combat infectious disease and other threats to public health simply do not exist to the needed degree in far too many places. Basic laboratory testing supplies and equipment are often unavailable. Health information systems remain

inadequate, making it impossible to monitor the delivery and coverage of interventions in a timely and effective way.'

9 Conclusion

It is clear from the literature review and case studies that investment in systems of governance and the development of health service infrastructures are essential if the benefits from science and technology are to be fully realised in addressing the global threats to human health from infectious disease.

The priority policy challenge for government now is to support a 'coherent international risk management approach' (Ottawa 2005) at national, regional, international and global level:

- To make the prevention, preparedness and response to global disease threats a key national and global security issue, with close cooperation between policy sectors such as public health, foreign policy and trade. Governments may wish to consider appointing a global health security advisor at a sufficiently senior level to effect such cross-government cooperation.
- To provide a clear rationale for (and agree on) a global public goods approach to prevent, prepare for and respond to major global disease threats, action could be taken within the EU, G8, Commonwealth, WHO and WTO. Such action could build on existing agreements, such as the IHR and the SPS agreement, as well as on the recommendations from recent international meetings on SARS and avian flu.
- To support the development of surveillance, exchange of information and rapid response, new financing mechanisms should be explored, based on a global public goods approach and separate from development aid. Investments are required for the weakest links, and in vaccine and anti-viral research and development.
- To enhance co-operation between the key, multilateral players in human, plant and animal health and in economic and social development, governments could work towards instituting at the global level a multi-sectoral mechanism. This would have the wherewithal to communicate rapidly with nation states and regional bodies such as the EU, AU, ASEAN and the G8.
- To ensure the full implementation of the IHR as quickly as possible, even before the respective deadlines.
- To explore the tripartite governance mechanisms that are best suited to ensure 'good global governance' of infectious disease control.

- To build public/private partnerships for global disease control in order to address the challenges at hand, with a special focus on containing the spread of outbreaks.
- To engage in a dialogue with the general public, NGOs and voluntary organisations.

For many of the non-governmental actors in the global health system, the equity dimension of global public goods is paramount. Indeed, they consider access to health as a right of citizenship (Berlinger 1999, Dower 2003, Singer 2002, Sen 1999). Sandler and Arce (2001) also draw attention to the fact that, if a society of nations views a healthcare activity as an inherent right, then it is a good, where equal access and consumption benefits all of humankind. The dimension of equity in particular has been a strong driving force in the debates on globalisation and health and the reason why, for many, a strengthening of the multilateral international organisations is so critical. For example, while patent arrangements must provide incentives for drug companies to invest fully in the development of new vaccines, cures and treatments, they must also ensure access to these developments to those who would not ordinarily be able to afford them. Undoubtedly, one of the next challenges in the global governance system will be to develop regimes for drug availability and burden sharing, particularly in the management of outbreaks. There is a European consensus that health is a good that should be 'consumed' universally. The understanding of the weakest link, therefore, can be in two directions:

- in terms of the economic understanding of GPG for the poorest country that cannot afford the measures needed to ensure the safety of its citizens and by extension adhere to its international responsibilities;
- in terms of a political understanding in rich countries that are not willing to fulfil their international obligations.

Both endanger, albeit in very different ways, the health of populations in this interdependent world. The 6th International Conference on Health Promotion in Bangkok, Thailand in August 2005 (The Bangkok Charter 2005) requested the WHO to explore more fully the potential of a global health treaty that would help define the responsibilities of the many actors in the global health arena.

The good news is that, for the first time in human history, the world can jointly prepare for a pandemic. All players in the polycentric, global health system must co-operate to develop a reliable global governance system for DIM that produces results, more equity and greater participation through tripartite governance. This would be the most critical step in ensuring our health and that of future generations.

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APPENDIX A

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Table 1. Taxonomy of Global and Transnational Health-Promoting Based on Benefit Rivalry Excludability

Class of Good	Properties	Examples	Implications/Remarks
<ul style="list-style-type: none"> <i>pure Public</i> 	<p><i>non-rival benefits</i></p> <p><i>non-excludable benefits</i></p>	<ul style="list-style-type: none"> <i>discovering a cure</i> <i>uncovering basic research findings</i> <i>curbing harmful pollutant with significant transnational reach</i> <i>developing treatment regimes</i> 	<p><i>Preference-revelation problem in terms of free riding. Because there is no cost to extending benefits, access to the good should be unrestricted. Suboptimal provision with disproportionate burdens placed on the rich nations or those with greatest preference. Neutrality property limits policy options. Equity issue over access.</i></p>
<ul style="list-style-type: none"> <i>impurely public but not a club good</i> 	<p><i>partially non-rival and/or partially non-excludable</i></p>	<ul style="list-style-type: none"> <i>monitoring disease entry points</i> <i>disseminating research findings</i> <i>curbing epidemics</i> 	<p><i>Because exclusion is not complete, some sub-optimality is anticipated with any allocation mechanism. There may be more incentives to support provision owing to partial exclusion and lack of substitutability. Neutrality is less of a policy concern. Must judge whether inefficiency warrants some form of intervention.</i></p>

<ul style="list-style-type: none"> • club good 	<i>excludable, but partially rival in terms of crowding (congestion)</i>	<ul style="list-style-type: none"> • <i>sharing of clinics/hospitals with global reach (e.g. Mayo)</i> • <i>communication network</i> • <i>technical consultation network via the Internet</i> 	<i>Voluntary clubs can change each use according to associated incremental crowding costs. Tolls not only internalises the crowding externality, but also can self-finance the good under some circumstances. For a large number of nations, multiple clubs can accommodate all. Equity concerns.</i>
<ul style="list-style-type: none"> • joint products (includes merit goods) 	<i>multiple outputs which can vary in their degree of publicness</i>	<ul style="list-style-type: none"> • <i>sharing surveillance data</i> • <i>immunising populations</i> • <i>teaching hospitals</i> • <i>deploying health-care workers abroad</i> 	<i>The extent of sub-optimality depends on the ratio of excludable to total benefits. As this ratio goes to one, markets and clubs can efficiently allocate resources. However, as this ratio approaches zero, the activity becomes more purely public and intervention is needed. Equity is a worry in either case.</i>
<ul style="list-style-type: none"> • private (marketable) goods 	<i>rival and excludable benefits</i>	<ul style="list-style-type: none"> • <i>medicines and vaccines</i> • <i>diagnostic test</i> • <i>spraying for disease-carrying pests</i> 	<i>Markets operate so that resources are directed to their most valued use. Developing countries will lack the means to purchase some of these goods. Remedies and medicines most suited to those countries will not be developed and sold. Equity concerns and the need for new institutions – e.g., partnerships – to address discovery, production and distribution of such goods.</i>

Table 2. Alternative Aggregation Technologies of Public Supply for Global and Transnational Health-Promoting Public Goods (TPGs)

Supply Technologies	Examples	Provision Prospects	Public Policy Implications
<ul style="list-style-type: none"> Summation: overall level of public good equals sum of individual contributions 	<ul style="list-style-type: none"> educating a people about a disease curbing incidence of disease assessing health risks medical aid during adversities 	<p>Likely contribution by richest nations. Under-provision with a need for public intervention at a supranational level. Prisoner's Dilemma outcomes anticipated with much free riding.</p>	<p>Supranational coordination or provision needed. Taxes or mandated contribution aimed at non-contributors, if feasible. A role exists for multilateral organisations and HGOs to support provision.</p>
<ul style="list-style-type: none"> Weighted sum: each agent's contribution can have a different additive impact on the overall level of the public good 	<ul style="list-style-type: none"> providing technical assistance abroad reducing harmful transboundary air pollutants removing toxins from shared environments spread of AIDS 	<p>A wide variety of outcomes are possible with varying degrees of sub-optimality. If provider receives a lion's share of its generated benefits, then it may be sufficiently motivated to act. Spill over patterns determine provision.</p>	<p>Need for intervention must be on a case-by-case basis. Some health-promoting TPGs may need no boost, while others will need assistance depending on the weights. Limited substitutability. Redistribution to favour contributors.</p>
<ul style="list-style-type: none"> Weakest-link: only the smallest effort determines the overall public good level 	<ul style="list-style-type: none"> prophylactic measures to limit a disease's domain eradicating a disease surveillance of an outbreak <p>sharing information in a network</p>	<p>Matching behaviour, where the smallest effort is mimicked. Suboptimality is expected to be less of a problem, especially when participants are more homogeneous.</p>	<p>If the standards met by the poorer nations are inadequate, rich countries may have to augment the poor's effort. NGOs and multilaterals may assist. Easy political sale for providing country.</p>

<ul style="list-style-type: none"> • Weaker-link: smallest contribution has the greatest marginal influence, followed by the next smallest and so on 	<ul style="list-style-type: none"> • <i>radicating a pest</i> • <i>collecting vital statistics for transnational data base</i> • <i>maintaining sterilisation port-of-entry quarantine</i> 	<p><i>Some equilibrium behaviour involves matching behaviour, while others do not. Unequal contributors with some agents doing somewhat more than others. Some co-ordination may be required.</i></p>	<p><i>Less need for public policy. The need for matching behaviour is less pronounced. When assistance is needed, a small subset of nations may require help from those who are better endowed.</i></p>
<ul style="list-style-type: none"> • Best-shot: only the largest effort determines the overall public good level the overall public good level 	<ul style="list-style-type: none"> • <i>finding a cure for a disease</i> • <i>isolating a bacteria or virus</i> • <i>developing a diagnostic procedure</i> • <i>human genome mapping</i> 	<p><i>A sole provider is anticipated. Earnings from the discovery can support efforts. Sub-optimality may or may not be a problem, depending on whether the good can be continuously varied.</i></p>	<p><i>Concentrating resources where there is expertise. Severely restrict the number of research groups. Coordination needed. Resources flow to agent best able to address problem.</i></p>
<ul style="list-style-type: none"> • Better-shot: largest contribution has the greatest marginal influence, followed by the next largest, and so on 	<ul style="list-style-type: none"> • <i>Providing specialised facilities (e.g., BL-4 laboratory)</i> • <i>polio vaccine discovery</i> • <i>discovering new antibiotics</i> 	<p><i>Sub-optimality is likely to be curtailed compared with best-shot. Multiple providers are anticipated. Incentives exist if can charge for breakthroughs.</i></p>	<p><i>Concentration of resources is less than in best-shot. Some coordination may still be required. Resources flow to agents with greatest likelihood of success.</i></p>

APPENDIX B

Case studies in the United Kingdom, sub-Saharan Africa and China

B 1 United Kingdom – Food-borne disease

B 1.1 Context

Food-borne disease remains a major cause of morbidity in the UK and other industrialised countries. Food-borne infections in the UK probably affect at least 1.3 million people a year and cause about 500 deaths (Adak, G. K., Long, S.M. and O'Brien, S. J. 2002). A study of all infectious intestinal disease (IID) suggested that the annual cost in England was £743 million at 1994/95 prices (Roberts, J. A. et al 2003). The timely DIM for food-borne infections and their causation is vital for effective control of common sources of infection and the identification of contributory factors in food production, distribution and preparation. Several of the main causes of food-borne disease are zoonotic pathogens, including, *Campylobacter spp*, *Salmonella spp* and *Eschericia coli 0157*.

Once food-borne disease is suspected, the Health Protection Agency (HPA) has to work in close collaboration with the environmental health officers in local government departments and, if a zoonotic agent is suspected, with the State Veterinary Service. When significant outbreaks are detected, the Department of Health, Department for Environment, Food and Rural Affairs and the Food Standards Agency (FSA) will be involved. When foods of animal origin are implicated, DIM is particularly challenging because of the many agencies and services that have to be involved at local, national and international levels. Information from DIM systems is used increasingly for sophisticated risk assessment and management.

B 1.2 Influences and change at local level

The UK has a good overall record of achievement in the field of public health, particularly in the control of infection. From time to time, extensive re-organisations of services have been implemented to address weaknesses in the existing arrangements. The last such event in England was the creation of the Health Protection Agency (HPA) in 2003, as part of a strategy to improve health protection. This re-organisation brought into a single body those with responsibility for communicable disease surveillance at local, regional and national levels. The specialist microbiological services and some of the regional laboratories of the former Public Health Laboratory Service were also incorporated into the HPA, but its other local laboratories were transferred to the National Health Service.

Dealing with infectious diseases will always require effective multi-agency working, and adapting to frequent re-organisations of services places a strain on those who are required to develop new working relationships, yet sustain continuity of service. The creation of the HPA followed the establishment of

new Strategic Health Authorities and Primary Care Trusts (PCTs). The development of health protection partnerships is complicated by the fact that Primary Care Trusts of the NHS, Health Protection Units of the HPA and Local Authority boundaries are not co-terminus. While in some areas there are satisfactory arrangements, in others there are complicated overlays, so that the Health Protection Units of the HPA have to build and sustain complex relations with multiple PCT and local authority teams.

Further reforms are being implemented in the NHS at primary care level. A report of the Select Committee on Health (House of Commons Select Committee on Health 2006) concludes that: 'the cycle of perpetual change is ill-judged and not conducive to the successful provision of health services.'

With the pressing needs of the curative services and current political and public pressure to reduce hospital-acquired infection, will NHS laboratories be able to give sufficient priority to public health problems in the community? This is likely to be a particular dilemma for laboratories transferred from the PHLS to the NHS that traditionally have been able to be proactive in this respect.

There is also the question of the importance that clinicians in hard-pressed PCTs place on surveillance and public health issues. Case reporting to surveillance systems is shaped by complex biological and social factors, of which illness severity appears to be the most important. A large study in England found that cases of IID reported to the national surveillance system are likely to differ from unreported cases in terms of illness severity, foreign travel, educational level and housing (Tam, C C, Rodrigues, L C and O'Brien S J 2003).

Some reporting is still paper-based, although gradually more laboratory and clinical data are being gathered electronically. There has been variability in the way in which information communication technology has been applied across the country, with little standardisation of platforms. In earlier years, tensions developed between the medical and veterinary services, partly as a consequence of political pressures around the salmonella and eggs issue in the 1980s. These strains have been largely resolved, but one consequence is limited linkage between surveillance of human infections and surveillance of infections in animals, including those resistant to antimicrobials. Much work has been done in recent years in recognition of the fact that collaboration is vital to the development of a robust and responsive infrastructure for human and animal health surveillance (Reynolds, D. and Donaldson, L. 2005). Progress also needs to be made in linking with food and environmental surveillance.

Another influence on surveillance has been a greater emphasis on confidentiality in the health services, with its practical embodiment through the Caldicott procedures. There is evidence to suggest that some clinicians have made an extreme interpretation of the rules and have been reluctant to comply with aspects of surveillance or investigations of suspected food-borne disease.

B 1.3 Influences and change at national level

Far-reaching changes have taken place in the arrangements for the prevention, risk assessment and investigation of food-borne disease, in part in response to two zoonotic food-borne disasters - salmonellosis and eggs and CJD linked to BSE in cattle. Progress has been made in key areas addressed by the Phillips Inquiry (Lord Phillips 2000): science and government and use of scientific advisory committees; openness; determining risk and uncertainty; good government and the legislative framework.

Responsibilities for food production and food safety now rest with separate, central government departments, drawing on the lessons from the bovine spongiform encephalitis (BSE) disaster. The FSA was established in 2000 to work 'at arms length' from central government to protect the public's health and consumer interests in relation to food. A significant development has been a much closer working relationship between those responsible for human and animal health. The Chief Veterinary Officer and Chief Medical Officer for England have described the many collaborations that enable improved identification and management of animal or human disease threats arising in the UK or globally (Reynolds, D. and Donaldson, L. 2005). One initiative that reflects a more proactive approach is the creation of the Human and Animal Infections and Risk Surveillance Group. This is fostering a multidisciplinary approach to understanding and controlling zoonoses and strengthening the capacity to predict, detect and manage the emergence of new infections (Walsh A L, and Morgan, D. 2005).

Reference microbiology and surveillance at national level are vital for controlling food-borne disease. The specialist microbiological services of the former Central Public Health Laboratory and the epidemiological services of the former Communicable Disease Surveillance Centre have international reputations for excellence. They undertake DIM at national level and provide support to local services. The centres have now been merged into the Centre for Infections (Cfi) as part of the HPA. Not surprisingly, the two centres have different cultures and approaches, as they are largely staffed by different scientific disciplines. There is a risk that one aspect will develop at the expense of the other to the overall detriment of DIM and control of infectious disease.

The surveillance of food-borne infections would benefit enormously from extending molecular diagnostic methods from national to regional and local laboratories. This would allow increased characterisation of strains of specific microorganisms to enable detection of linked cases and unusual patterns. Furthermore, automated real-time reporting of molecular results could allow the rapid detection of cross- boundary or national outbreaks. Thought needs to be given to the disincentives and incentives to Cfi laboratories of giving priority to developing and rolling out the required technology.

B 1.4 Conclusion

The UK has a well-developed DIM capacity for food-borne disease but, as in most countries, faces particular challenges in sustaining effective working across local, regional and national administrative levels. Another layer of complexity is added with the requirement for collaboration and co-ordination between the administrations in England, Scotland, Wales and Northern Ireland, as well as with several central government departments and agencies. However, the far-sighted decision to establish the HPA in England offers a unique opportunity to ensure coherence of DIM services from local to national level.

Recent events have identified the need for increased collaboration between those working with DIM systems in human and veterinary practice, particularly in reference microbiology and surveillance. Much progress has been made in strengthening the arrangements for collaborative responses to outbreaks of zoonotic food-borne disease as well as in horizon scanning, risk assessment and risk management.

B 2.0 China - SARS-like outbreak

B 2.1 Context

This case study attempts to explore the steps involved in recognising the potential threat of SARS in China and the public health services response. It draws on newspaper reports as well as accounts published in the scientific press (Kleinman, A and Watson, J.L.) and published and unpublished information kindly made available by WHO.

B 2.2 Recognition of the potential public health threat of severe acute respiratory syndrome

B 2.2.1 Clinical vs. public health perspective

The earliest local event that might reasonably have been considered a significant public health event took place on December 15, 2002, when a patient from Shenzhen was admitted to Heyang hospital in Guangdong Province with severe pneumonia. In the following days, several additional patients were admitted and 6 physicians and nurses in the hospital presented with respiratory symptoms, three of them developing respiratory failure. The Department of Health of Guangdong province despatched a team of epidemiologists, microbiologists and infectious disease specialists to investigate the outbreak. The investigation report attributed the outbreak to atypical pneumonia and recommended infection control measures to prevent further transmission.

However a retrospective investigation has determined that a family cluster of what is likely to have been SARS, involving 5 pneumonia cases, had occurred in Fushan City, Guangdong Province in mid-November and was reported to health authorities as scrub typhus.

In mid-January 2003, family and hospital clusters of similar severe pneumonia were detected in Zhongshan City. The Guangdong Centre for Disease Control carried out a field survey and a preliminary report was presented to health authorities of an outbreak of respiratory infection of unknown origin (not a reportable disease at that time in China). The report estimated the incubation period to range from 1 to 11 days, and suspected the transmission to be either from person-to-person or through indirect contact. The causative pathogen was unknown. A request was sent to the China Centre for Disease Control in Beijing to assist in the investigation of this outbreak of unknown origin and a Beijing team visited Guangdong.

From January 20 to 28 other cases of atypical pneumonia were reported in Guangdong province from Guangzhou, Zhongshan, Fushan and Zhuhai. Several of these cases were in health workers. Even though there was a mechanism in place to report a public health emergency, this was not triggered in a timely way. Physicians had never encountered such an emerging disease, and lacked experience in responding appropriately. At this stage, they were not able to assess the magnitude of the threat. Delays in implementation of preventive measures resulted in a failure to control the spread of the disease in the community.

B 2.2.2 A threat to governance: the temptation of concealing information

In February 2003, the disease peaked in Guangdong province, with 10 to 15 new cases admitted daily. On February 9, WHO issued a global alert from its Geneva headquarters reporting the occurrence of more than 300 cases of severe acute respiratory syndrome (SARS) with the main focus being reports from Vietnam.

On February 22, a patient was admitted to hospital in Hong Kong where the disease spread. By the end of February, 789 cases had occurred in Guangdong province, and cases were reported from Hong Kong, Vietnam, Singapore and Canada.

In March 2003, travellers returning from Guangdong spread the disease to Shanxi, Beijing, Guangxi and Hunan provinces. One patient was referred to a tertiary hospital for suspected viral pneumonia. This patient infected the ambulance driver and several medical staff in this hospital. Following much prompting from WHO and informal contact with the WHO office in China, the Ministry of Health officially informed WHO of an outbreak of atypical pneumonia that was being brought under control. Soon after, similar cases of the disease linked to a patient originating from Guangdong province appeared in neighbouring countries. Requests were sent by WHO in Beijing to the Chinese authorities for additional information on the nature of the problem in the province and the control measures that had been implemented. WHO offered assistance in the investigation. Responses to these requests were delayed and information was seeming concealed, perhaps because the nature of the problem was not clearly understood. The magnitude of the threat was not fully perceived and it did not fit within the requirement of the International Health Regulations at that time which only required prompt reporting of a handful of named infections, not mystery new illnesses. Eventually, requests

for international collaboration were answered positively and a team from WHO arrived on March 15.

From March to mid-April 2003, SARS spread rapidly in Beijing and northern provinces of China.

B 2.2.3 A challenge for governance: the need for a national coordination

On April 9, 2003, the Minister of Health organised a meeting of directors of provincial health departments to assess the epidemiological situation. Large Chinese teams were dispatched to the provinces to undertake further investigations. National authorities probably realised the extent of the problem after an international alert was issued along with a travel advisory to the province. Because of delays in communications, timely epidemiological information was not available at national level. In mid-April 2003, a consultation with all the provincial health authorities was undertaken, which showed that other provinces were facing a similar increase in cases of severe acute respiratory syndrome. The State Council reviewed reports from the provinces and realised that the Ministry of Health had not communicated information about the extent of the epidemic. Furthermore, it was apparent that the control measures had not been effective in preventing the spread of the disease. It was decided that coordination of the investigation and response was a national priority, but the task proved to be difficult in the absence of procedures for implementation. This deficiency resulted in discrepant information being released from various sources and provinces. Different case-definitions were used in the provinces, sometimes in an attempt to lower the magnitude of the problem, despite the fact that country leaders had issued directives to ensure that no under-reporting took place.

B 2.2.4 A switch of governance: the involvement of the Communist Party

Because of these failures and specifically the under-reporting in Beijing, the Minister of Health and the Deputy mayor of Beijing were dismissed from their positions and the State Council took control. The Chinese Communist Party organisation was used to launch mass intervention and ensure that national decisions were translated into local actions and policies. SARS was included in the public health law as a reportable disease, national guidelines were issued, and some theatres and other recreational facilities closed down. It was announced that treatment of people with SARS would be free and a new hospital for SARS patients was built in 8 days. Millions of residents were mobilised to clean private and public facilities and attend public health lectures. A 'patriotic public health campaign' was launched. Quarantine for people in contact with cases was implemented, as well as a ban on sales of civet cats. Initially some of the drastic actions did have perverse effects, for example there were significant numbers of internal migrants who fled Beijing when the sackings of officials took place. These were people of unclear residential status who were afraid they might be caught in control measures. This may have helped disseminate the infection to some other cities. However, overall these measures did not create social unrest as they were accepted by a population that was inclined to comply with party regulations. Information was still generally controlled at national level in order to minimise

the political impact of the outbreak and to ensure stability. However, these belated control measures were too late to prevent the impact on international trade and travel as the problem had already become a global governance issue.

By the end of April 2003, 402 cases had been reported by Beijing alone, representing a dramatic increase compared to the start of the month. As a result, a series of stringent control measures were implemented there, including the closing of schools, the limitation of human gatherings and the isolation of people in contact with SARS patients.

By May 2, 3799 SARS cases, 181 deaths and 2459 suspected cases had been reported in mainland China, 1636 cases from Beijing, 1421 from Guangdong, 311 from Shanxi, 180 from Inner Mongolia, and 70 from Hebei. Beijing health authorities built a 1000-bed infectious disease hospital (Xiaotangshan) in 8 days, for treating patients.

Several difficulties were encountered in processing data during this epidemic. There was no mechanism of cluster detection and reporting. It proved difficult to coordinate the data flow from the 167 hospitals involved in SARS surveillance, especially with a system dedicated to central reporting. Under-reporting was noted, data was sometimes incomplete and the case notification system saturated. The complexity of the case-investigation form as well as changes in the case definition further hindered the process.

The number of cases started to decrease towards the end of May 2003 as strict control measures were implemented and guidelines developed. By the end of June 2003, the SARS epidemic was under control in China as the switch of governance approach resulted in the implementation of effective control measures.

B 2.3 Conclusion

The country was not adequately prepared to deal with an emerging threat of international scope. The main factors producing delays in the detection and investigation of SARS were related to: (i) an approach targeting individual patients rather than communities, (ii) the lack of tools allowing the monitoring of the epidemiological situation, notably there being no formal cluster detection and reporting system, (iii) a dilution of the chain of responsibility, (iv) a lack of horizontal and vertical communication, (v) a denial of the magnitude of the problem and (vi) a weak coordination mechanism at national level with a small and under-powered Ministry of Health with low status among national bodies and (vii) a general neglect of public health as local, provincial and national functions.

After large epidemics in the first part of the 20th century had largely been controlled, health and healthcare gradually lost their recognition as a public good in the country. The main governance issues were related to the weak articulation between local and national bodies, resulting in poor information sharing. Coordination was complicated by the complexity of the healthcare system, with district and provincial bodies (governorates and mayors) and a

national Centre for Disease Control under different structures and a lack of any over-riding public health system. A switch of governance was required to control the outbreak, but this happened late in the course of the epidemic. Furthermore, the vertical governance approach of the national authorities, linked to the former International Health Regulations, conflicted with the global governance approach of the competent international organisations.

B 3.0 Sub-Saharan Africa - Meningitis outbreak

B 3.1 Context

Large, seasonal meningococcal meningitis outbreaks occur in sub-Saharan Africa from November to June, affecting thousands of patients and resulting in a high death toll. WHO is supporting countries from the region to co-ordinate the response to these outbreaks by facilitating the provision of vaccine, drugs and laboratory reagents. Recently, a new W135 strain has emerged, requiring a microbiological examination to be performed on cerebrospinal fluid of suspected cases. The microbiology results from a sample of patients are essential to identify the appropriate vaccine for a mass campaign which will be implemented when the incidence of the disease reaches epidemic levels. WHO has established an international co-ordinating group (ICG) for vaccine provision to affected countries. The process depends on the timely identification of the circulating strain of the germ at local level and ensures that vaccines are used where they are most needed to prevent waste.

Regional guidelines exist, providing a rational basis for intervention, in an attempt to optimise the use of limited resources. At the district level, public health authorities are requested to monitor the incidence of the disease within their populations. Alert thresholds are used to launch investigation of the circulating strain through laboratory analysis of cerebrospinal fluids. Incidence over the alert threshold two weeks in a row should trigger a mass vaccination campaign to prevent an epidemic. These mass campaigns represent a huge logistical challenge for districts as vaccine, cold chain and treatments need to be dispatched often to remote areas of the country.

This case study explores the factors affecting the timely detection and investigation of such seasonal epidemics.

B 3.2 Detection of the seasonal increase

All physicians in the country are well aware of the seasonal nature of meningococcal epidemics. The disease is under mandatory notification, as recommended by the WHO regional office, and patient care guidelines are available in most facilities. Physicians often use presumptive antibiotic treatment for meningitis because of a lack of laboratory confirmation. Cases are registered on the hospital logbook and reported weekly to the district public health authority, as the total number of cases cared for in the previous week in two age categories, under five and five years and over.

Even if hospital-based clinicians can detect an increase in cases seeking medical care, public health interventions are triggered by district level incidence calculations in accordance with national guidelines. Thus, primary care providers are not in a position to trigger an alert.

Reporting forms are sent weekly, usually using local transportation, to district health authorities where they are checked for completeness of information. Most districts are now equipped with computers, and the numbers of cases reported are entered in an Excel spreadsheet which automatically calculates the incidence based on the district population. This process can be delayed as power supply is often disrupted, and computers lack maintenance and are prone to being infected by viruses.

The decision-making process requires that all reports are available in order to accurately estimate the incidence on which interventions are to be based. However, achieving 100% report coverage may take several weeks, resulting in an underestimation of the incidence and perhaps a delay in raising an alert.

B 3.3 Investigating an alert

The investigative response to an alert consists of sending appropriate sampling equipment and transport media to hospitals in the district to enable samples to be collected and the circulating strain determined. Often, stocks of such equipment are kept at district level, and shortages are not uncommon.

The timeliness of the investigation is crucial for an effective response. A seasonal epidemic may sweep across districts in a few weeks, so the success of a mass campaign relies on early vaccination, before it peaks. Delays can occur when hospital doctors are involved in concomitant private practice to supplement their low levels of income from hospital work. Samples need to be promptly processed by a reference laboratory, and transportation remains an issue in many districts.

B 3.4 Launching mass campaigns

If the alert threshold is sustained for two weeks in a row, a mass campaign should be launched once the circulating strain has been identified. District commissioners are informed but are sometimes reluctant to intervene because of the implications of such a decision in districts affected by political unrest.

Vaccine stocks are usually maintained centrally or at provincial level and have to be kept refrigerated. A black market in vaccines is not unusual since vaccination is a requirement for anyone attending the Hajj pilgrimage. It has been documented that vaccines were faked in some instances, or re-packaged after use with inactive products. In addition, social and religious unrest in some areas resulted in the population lacking trust in the vaccination, following suggestions that injections could be used to poison or sterilise them.

International, non-governmental organisations have long provided support to these countries in responding to meningococcal seasonal epidemics.

B3.5 Conclusion

The threat posed by seasonal epidemics of meningococcal meningitis is well known in these countries and perceived as important. Recognition of the threat, however, does not necessarily impact on timely identification and response. The main factors influencing detection and investigation of meningococcal outbreaks in sub-Saharan countries relate to delays at each event of the decision-making process, compounded by lack of resources and motivation from public health staff, along with the potential adverse political or religious impact of acknowledging the epidemic.

While health is generally identified as a public good, governance is challenged by lack of resources, the sensitivity of minorities and weakness in the form of corruption. In addition, public health governance relies heavily on international agencies and non-governmental organisations, resulting in a lack of investment from national authorities.

Table 1: Influence of legislation, regulatory structures and societal factors on the detection, surveillance and control of infectious diseases in humans

		International legal and regulatory framework	Regional legal and regulatory framework (EU as exemplar)	National legal and regulatory framework	Investment in science and technology	Sharing of data in a timely fashion	Religious, societal beliefs, concerns, and human rights issues
Preparedness	Risk analysis & prioritisation	+	++	+++	+++	+++	++
	Development of policies	+	++	+++	+++	+	+++
	Preparedness plans	+	++	+++	++	++	+++
Detection/ surveillance	Diagnosis and confirmation	+	+	+	+++	++	+++
	Data collection/ sampling	+	++	+++	+++	+++	+++
	Data collation	+	++	+++	+++	+++	++
	Analysis and interpretation	+	++	+++	+++	+++	+
	Information dissemination	+	++	+++	+++	+++	++

Response/ containment/ control	Investigation of new trends and unusual events	+	++	+++	+++	+++	++
	Implementation of contingency plans	+	++	+++	++	+++	++
	Application of control measures/preventive actions	++	++	+++	+++	+++	+++
After containment/ control	Evaluation of response	+	+	++	+++	+++	+
	Ongoing monitoring	+	+	++	+++	+++	++

Note: + suggests a limited influence and +++ a prominent influence currently. Yellow shading highlights aspects most likely to be of greater importance in 10 to 25 years.

All the reports and papers produced within the Foresight project 'Infectious Diseases: preparing for the future,' may be downloaded from the Foresight website (www.foresight.gov.uk). Requests for hard copies may also be made through this website.

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