REVIEW

Responding to the Challenge of Communicable Disease in Europe

Laura MacLehose,[1] Martin McKee,[1] Julius Weinberg[2]

In the 1960s and 1970s, communicable disease seemed a minor threat, but since then the emergence of new infections and the reemergence of old diseases has provoked a renewed focus on European communicable disease surveillance and control. A "network approach" among European countries has been successful in detecting some international outbreaks, but management and funding aspects remain unresolved. Surveillance outside the European Union has faced new challenges as a result of economic and political change following the collapse of communism. Subsequently, innovative international surveillance schemes are currently being implemented in the countries of Central and Eastern Europe and the former Soviet Union. The challenge for surveillance in Europe is to ensure that it has the capacity to meet both the needs of today and the diseases of the future.

Modern Europe has been shaped to a surprising degree by the continuing battle between humans and infection (*1*). The demise of the Roman Empire was hastened by an outbreak of plague in the fifth century (*2*). When plague struck again in the 14th century, the scale of devastation undermined the authority of the church, paving the way for the reformation (*3*). In the 16th century, viruses to which Europeans had developed immunity devastated the indigenous peoples of the Americas, shifting the balance of power within Europe and ushering in several centuries of European global dominance (*4*). In the 19th century, the threat posed by infectious disease in the industrial slums stimulated the rise of communism (*5*).

However, by the late 1960s and 1970s, there were claims that it was time to "close the book on infectious diseases." Immunization programs dramatically reduced the risk from common infections, and growing numbers of antibiotics offered ever more therapeutic possibilities. It seemed only a matter of time before diseases such as poliomyelitis, measles, and tuberculosis would be eradicated as smallpox was.

This optimism was unwarranted (*6*). Changes in the social and physical environment have provided new opportunities for infectious diseases. Thus, the spread of human immunodeficiency virus (HIV) was facilitated by evolving social mores, and greater world travel has eased rapid movement of disease between countries. Legionnaires' disease only became a significant threat to human health once an efficient delivery system was provided for it, in the form of cooling systems for air conditioning. The reemergence of old infectious diseases and the emergence of new threats have posed major challenges to existing surveillance systems in Europe and elsewhere (Table 1.)

Rapidly changing circumstances have challenged the ability of established surveillance systems to deliver timely and appropriate information. These challenges have been particularly marked in Europe (*7*). In the West, the development of the European Union (EU) has removed barriers to movement of people and goods. In the East, many barriers to international movement have been reduced, most visibly with the tearing down of the Berlin Wall. At the same time, others have appeared as new nations emerge from the collapse of the Soviet Union and Yugoslavia, often accompanied by major social and economic disruption. In the South, wars and economic crises in Africa have fueled migration on an unprecedented scale.

Development of surveillance.

Communicable disease control in Europe has its roots in the Adriatic in the 15th century. In response to the threat of infectious disease, especially plague (*1*), the Venetians introduced quarantine (from the Italian *quarante die* meaning 40 days) at their ports, a strategy subsequently adopted throughout Western Europe. From the beginning, quarantine was contested by those advocating "Free Trade" but, by the 19th century, it was apparent that it was ineffective in preventing the spread of its main target, cholera. To address these concerns, the first International Sanitary Conference was convened in Paris in 1851. Subsequent International Conferences resulted in the establishment of a permanent International Committee on Epidemics (1874) and the adoption of the International Sanitary Convention (ISC). Successive conferences paved the way for the current mechanisms for international control of infectious disease, and by 1903, the ISC agreed that states would "immediately notify the other governments of the first appearance in its territory of authentic cases of plague or cholera" (*8*). This led to the International Health Regulations (IHRs), adopted by the World Health Assembly in July 1969. Although the IHRs reflected thinking in the late 1960s, they have many weaknesses, such as the limited number of diseases covered and the outdated mechanisms for information transmission (*8*). They are currently being revised (*9*).

Surveillance has traditionally been seen primarily as a national responsibility. From the end of the Second World War, Western Europe and the countries of the communist bloc took different approaches to organization of communicable disease control. Both were based on local reporting of suspected infection, but the highly centralized Soviet system prioritized laboratory over epidemiological investigation, so that local epidemiological capacity was weak. In Western Europe, a variety of models was used. Some countries, particularly those in Scandinavia, the Netherlands, and the UK, had strong national systems with effective local or regional elements and a network of local experts able to undertake epidemiological investigations; these systems were less well developed in southern Europe.

Both systems have been criticized for failing to link surveillance sufficiently closely to action—this has particularly been true in Eastern Europe. Recognized weaknesses in national systems have led to reorganization in several Western European countries. For instance, France and Germany have recently introduced new laws to strengthen their national surveillance systems, and even the UK, which is often considered to have an effective system, has proposed a major restructuring that will create a new national agency in England combining a range of existing surveillance and control functions (*10*). A major stimulus to change in many countries has been recognition of the threats posed by antimicrobial resistance and hospital-acquired infection (*11*).

The European Union.

European countries have participated in the World Health Organization activities since its inception and have worked to meet global goals (such as the campaigns for the eradica-

[1]European Observatory on Health Care Systems, London School of Hygiene and Tropical Medicine, Keppel Street, London, WC1E 7HT, UK. [2]City University, Northampton Square, London, EC1V 0HB, UK.

tion of smallpox and polio). However, until recently, much data exchange was mechanistic and slow, suitable for the production of annual reports but not for public health action. The EU has taken a leading role in international disease surveillance developments within its boundaries and increasingly in those countries of Central and Eastern Europe that aspire to join it.

The close links between trade and communicable disease made it inevitable that coordination mechanisms would be created within the EU, but until the 1990s, progress was impeded by member states' guarding their national autonomy in matters of public health. Health had been mentioned in the Treaty of Rome, which established the then European Economic Community in 1957, but was limited to some aspects of occupational health in workers in the coal, steel, and atomic energy sectors (*12*). A commitment in the 1985 Single European Treaty for EU policies to promote health was used to justify programs to tackle cancer and acquired immunodeficiency syndrome (AIDS). However, a specific responsibility for public health only emerged in the 1992 Treaty of Maastricht (*13*), which provided a basis for cooperation between member states for disease prevention. This provision was strengthened in the 1997 Treaty of Amsterdam (*14*).

The informal "Charter Group," which brings together heads of EU national communicable disease centers, resulted from the perceived gaps and duplications, with little strategic direction, found in the surveillance mechanisms used across the EU. One of its first activities was to reach consensus on priorities for supranational surveillance activities (*15*). Subsequently a Network Committee was established, with two representatives (usually one epidemiologist and one representative of the Ministry of Health) from each member state.

Action within the EU has been funded in part by the European Commission but with substantial additional contributions from national institutes. This includes the creation of disease-specific surveillance networks, bringing together microbiologists and epidemiologists from different countries, as well as contributing to infrastructure developments.

Surveillance networks now exist for enteric infections, legionellosis, tuberculosis, and other communicable diseases, as well as for antimicrobial resistance. Many of these networks have established systems of routine, regular data interchange and early warning systems, enabling analysis of trends, detection of international outbreaks, and rapid exchange of information on unexpected events (*16*).

The infrastructure includes regular electronic and printed surveillance bulletins (*17*) and a training program for epidemiologists: the European Programme in Intervention Epidemiology Training (EPIET) (*18*). The EPIET program seeks to raise the standard of communicable disease surveillance across the EU by producing a cadre of highly trained individuals competent to undertake epidemiological investigations at the international level.

An EU-wide rapid alert system has also been established, allowing for rapid transmission of confidential data between national health authorities, which may be useful at an early stage in an unconfirmed outbreak. For example, this system was used in alerting EU member states about a highly lethal disease outbreak among injecting drug users in Scotland, and through this information exchange, further cases were identified in Ireland (*19*).

Although the existing networks have enabled early identification of outbreaks that might otherwise have been overlooked for some time or even missed completely, recent research has identified certain weaknesses, such as a lack of clarity about funding and of responsibility (*20*). There are also important gaps in geographical and disease coverage, as participation is voluntary.

There are also concerns about the optimal structure for surveillance in Europe. Should collaboration be based on a series of disease-specific networks linking existing national centres or should there be a single European structure, modeled on the U.S. Centers for Disease Control and Prevention (CDC) (*21–24*)? Some dissenting voices remain (*25*); however, agreement was reached in 1998 to pursue what was now termed the "network approach" (*26*). This will involve a more proactive program leading to a formal "Community Network" in which an agreed-upon list of infections will be covered (*27*).

Central and Eastern Europe and the Former Soviet Union.

The Soviet system gave a strong emphasis to communicable disease control, reflecting Lenin's famous remark that "If communism does not defeat the louse, the louse will defeat communism," as well as fears of biological warfare. Consequently, surveillance systems were well organized, but they have failed to keep pace with developments elsewhere and were often unable to take effective action on the basis of their data.

Some eastern European countries already participate in the EU surveillance networks, especially in countries aspiring to join the EU. The European Regional Office of WHO has also been active in developing collaborative networks and supporting infrastructure developments to enhance surveillance. The WHO Computerized Information System for Infectious Diseases (CISID) began in 1998 with sharing of routine information and urgent alerts among WHO's 51 member states throughout its European region. The routine data element is now in place, but the early-warning component is still in a pilot phase involving seven Eastern European countries.

One legacy of the Soviet Union is the inclusion, within the WHO's European region, of the former Soviet Republics of the

Table 1. Evolving threats to human health from infectious disease; framework derived from (*9*).

New technology	The use of ruminant-derived protein in cattle feed, accompanied by changes in the way in which material was rendered, created a cycle of prion transmission in cattle that, by the end of 2001, led to infection of almost 200,000 cases of bovine spongiform encephalopathy (BSE) in cattle and over 100 cases of human new variant Creutzfeld-Jakob disease (*41*).
Environmental and land use change	More intensive agriculture in some parts of Bulgaria, accompanied by extensive irrigation, has been associated with a substantial increase in cases of leptospirosis since 1990 (*42*).
Travel and trade	Cases of falciparum malaria imported into the UK increased by almost 50% between 1990 and 1999, reflecting the growth in international travel (*9*).
Climate change	Changing climate underlies a contraction of the distribution of tick-borne encephalitis in central Europe (Hungary, Croatia, Slovenia) but the emergence of new foci of disease in Scandinavia (*43*).
Microbial adaptation	Worsening social conditions, coupled with inadequate treatment, have led to a dramatic increase in cases of multidrug-resistant tuberculosis in the former Soviet Union (*44*), which is also posing a threat to countries in Western Europe (*45*).
Human behavior	A breakdown in social norms, coupled with a large increase in commercial sex trade in Eastern Europe has led to an explosive increase in cases of syphilis (*46*) and HIV infection (*47*).
Impaired immunity	There are more people at risk of opportunistic infections because of impaired immunity, for example, because of coexistent HIV infection or immunosuppressive drug therapy. The coexistence of high rates of tuberculosis and AIDS in the former Soviet Union is a major cause for concern (*48*).

Caucasus and central Asia. These countries face enormous problems, with economic collapse and, in some cases, civil conflict, and grave consequences for communicable disease control (*28*). Most recently, the Central Asian Republics have confronted large-scale migration as a result of the war in neighboring Afghanistan. All are, however, participating in the WHO's network development activities.

The situation in the Baltic Republics is somewhat more optimistic, with a major subregional initiative: The Task Force on Communicable Disease Control in the Baltic Sea Region, supported by the governments of the Nordic countries (*29*).

Remaining Challenges.

Despite many successes, weaknesses remain, affecting all aspects of surveillance from the detection of outbreaks to the implementation of an effective response (*20*, *30*). Effective action is only possible if an outbreak is identified. This means that high-quality, rapidly responding national surveillance systems must be in place. Unfortunately, the quality of national surveillance programs varies considerably (*31*, *32*). In some countries in Western Europe, a combination of strict data protection laws, jealously guarded independence of the medical profession, and weak public health capacity means that notification is incomplete and outbreaks go unrecorded or uninvestigated. In Eastern Europe, there is an additional problem of inadequate laboratory support as, despite massive capacity in the Soviet-model sanitary-epidemiological system, laboratories have suffered from decades of underinvestment and are poorly equipped to investigate emerging infectious agents requiring specialized facilities. However, even if cases are detected by national programs, they may not be reported to other countries, especially where a network for that agent has not yet been established (although the new EU early-warning system may provide a solution).

A second potential weakness lies in the coordination of outbreak management and investigation. The coexistence of national centers and EU-wide networks has led to a lack of clarity about where responsibility for managing international investigations lies. Should the lead be taken by the country that identifies the outbreak, the country with most cases, the coordinators of the network in question, or someone else? Although several different approaches have been taken, the need for a clearer framework is now recognized (*33*).

There may also be problems coordinating responses, especially where the recommended actions differ. Diversity exists even for relatively common infections, for example, which contacts should receive chemoprophylaxis after an outbreak of meningococcal disease (*34*). The difficult balance between trade and health is ever present, illustrated by the difficulty in closing hotels that are suspected sources of *Legionella* infection (*35*, *36*).

European communicable disease control has long suffered from insecure and often inadequate funding. Within countries, communicable disease control often only becomes a priority once there is a major outbreak, with either many deaths or a major economic impact. The situation is further complicated at the European level, where support from the European Commission has often been delayed, inadequate, or of limited duration. For example, a threat now hangs over the continuation of the EPIET training program (*37*). The uncertainty of EU funding creates an additional administrative workload and poses challenges to sustainability and the development of institutional memory. A further problem is that the conditions attached to EU funding may, at times, make it difficult to respond rapidly to changing situations. Thus, with a few exceptions where alternative funds could be identified, Europe has been unable to participate in a number of investigations of outbreaks occurring in other parts of the world, even where there are important implications for Europe. This is in marked contrast to the U.S. CDC, to whom the role of global outbreak investigator has fallen. This is a situation that is clearly far from satisfactory, on many grounds, but in particular, because of the potential consequences when an outbreak occurs that poses a threat to Europe, but is not a priority for the USA.

Finally, there are major weaknesses in Europe in terms of emergency preparedness. This was apparent in the aftermath of the deliberate dissemination of anthrax in the USA in 2001. Many of these weaknesses had been highlighted the previous year in a study that found, in the wake of the 1997 outbreak of avian influenza H5N1 in Hong Kong, that less than half of EU member states responding reported having preparedness plans to deal with a human influenza pandemic. Despite the open borders within the EU, there was no plan for coordinated European action (*20*). Ironically, such a plan did exist for an outbreak among poultry, reflecting the priority given to the agriculture sector in EU politics.

Since the attacks on the United States on 11 September 2001, EU preparedness has had a greater priority (*38*) as a "third strand" of the Community Network. However, the main developments have been within the "third pillar" of EU action, which is based on intergovernmental cooperation that has traditionally dealt with issues such as criminal justice and intelligence sharing. Thus, in October 2001, a 24-hour "Civil Protection Network" was established linking Interior Ministries and their equivalents (rather than Ministries of Health or national surveillance institutes) to enable collaboration concerning nuclear, biological, and chemical threats (*39*).

Conclusions.

The challenges thrown up by a changing world require new solutions. Political initiatives and technological change have led to upheavals that demand fundamental changes in the way that European surveillance is undertaken. The population at risk from an outbreak may now span many countries. Exchanging data between countries enables public health authorities to identify threats to health early (some sources of infection may only be identified by pooling data on cases from different countries) and, when allied to effective interventions, international surveillance can reduce the number of people affected.

European communicable disease control has traditionally been a local affair. Although the local element will continue to be key, the changing environment makes international coordination more important than ever. National frontiers have never been barriers to infection, and an effective response often requires concerted international action. Action is required both for improving international surveillance within Europe and for assisting surveillance initiatives in those countries beyond the European borders that request financial or technical support.

Yet, international surveillance is not easy. Despite the new opportunities afforded through electronic communication technology (*40*), different legal and cultural frameworks, blurred lines of accountability, and uncertain financial responsibility all pose problems. Collaboration is expensive, in both financial and human terms. Without additional resources, underfunded and overstretched national bodies can only sustain involvement in a few collaborations.

So far, much of the collaboration has depended on the enthusiasm of individuals, and cross-subsidies from other activities. Yet, if networks are to be effective in linking data to action, they depend on robust national and international infrastructures. They also require dedicated and adequately resourced management. These are challenges that Europe has yet to resolve.

Social, political, and environmental change will reveal novel threats from infectious diseases, arising naturally, iatrogenically, or purposely. One of the greatest challenges facing surveillance systems is awareness of the unexpected, recognizing when things seem not quite right. Nipah virus was thought to be Japanese B encephalitis, West Nile virus in New York was thought to be St. Louis encephalitis, and prions were thought not to cross species barriers. Focusing surveillance systems on the diseases of today fails to address the challenges of an uncertain

future. Early identification of new threats will depend on sustained investment in generic surveillance systems, staffed by people from many disciplines but, most important, the capacity for lateral thought.

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