Emerging Infectious Diseases: current status and future perspectives

In 2009 the French High Council on Public Health, in order to support future national policy, took the initiative to respond to the need to produce a collective work entailing both qualitative and quantitative consideration of how to best manage and react to future public health crises connected to an emerging infectious disease (EID).

Summary

Emerging infectious diseases: current status and future perspectives

Emerging Infectious Diseases (EIDs) result from infection with a microorganism, previously unknown or known for some time but that have emerged from changes in host, vector, pathogenicity or drug resistance of a new strain, geographic distribution or environmental conditions. Considering EIDs impacts on social, economical and political decisions and issues in a globalizing world, the present report focused on human EIDs develops four components: EID case-studies, current knowledge about determinants and situations of emergence, surveillance indicators and disease risk assessments in public health, and contribution of social sciences to basic knowledge, forecasting and health policy decisions.

Key words
Infectious diseases, infection, emerging infectious disease, infectious risk, epidemics

For further information

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Synthesis – Status assessment

Long a major cause of death around the world, infectious diseases (ID) are still responsible for 43% of deaths in the least-developed countries, whereas they have declined in more developed ones (1% of all deaths) thanks to improved hygiene and urban sanitation, to antibiotics and to vaccinations. The fight against epidemics is also part of French national public health policy laws as of August 9, 2004.

Emergence factors and situations

The emergence of new infectious agents is most often the result of a complex combination of different factors, often insufficiently understood. As the central player, humans are exposed given an increased susceptibility which can be due to a temporary or prolonged alteration in their means of defense and to changes in behaviour. The environmental factors may be physical or ecological (destruction etc.), socio-economic (war, close contact between humans and animals, changes in their respective habitats, etc.) or organisational (lack of adequate sanitation system). Changes in the infectious agent may also intervene through genetic mechanisms or pressures of selection. Areas of emergence are characterized by instability leading to an imbalance of multiple dynamics between the causative agent, its host populations (reservoirs or vectors) and the environment. The exceptional biological diversity of microorganisms and their accidental transmission to humans are discussed via a few simple examples such as the emergence of microorganisms’ resistance to antibiotics.

Indicators and means of surveillance

Early prediction and detection is founded upon epidemiological surveillance, ongoing and systematic analysis of data gathered from medical practitioners, biologists, national reference centres, veterinarians, entomologists, meteorological services and environmental “watchdog” organisations; police, customs, the military, and national and international agencies. This analysis concerns infectious agents and their behaviour, the diseases they cause, and factors linked to the host and to the environment. Analysis of warning signs should thus make it possible to rapidly evaluate the risk to public health and to define what measures should be taken. Indicators will make possible the surveillance of:

- the overall population;
- caregivers and care centres;
- specific at-risk populations in function of their professions or geographic location;
- vectors involved;
- animal reservoirs;
- the environment;
- changes in socio-economic and cultural behaviours.

The difficulty in surveillance lies in the necessary reconciling of research on the greatest possible number of pertinent signs with the huge task of reinforcing intermediate processing of signs already recorded, in order to continuously adjust decision-making to characteristics of the phenomenon as it occurs.

Social Sciences - Contributions

Given the role of human beings as key players in emergence, the social sciences should also play a large part in helping to monitor EIDs and their consequences. They should allow us to better take into account certain “inequalities of vulnerability,” and thus to offer responses adapted to local and regional contexts.

Recommendations

Four major points:

- a global, interdisciplinary approach,
- an expert health monitoring group,
- a flexible generic and strategic plan,
- an interministerial emergency fund.

Five case studies are proposed: establishment of primary prevention of HIV/AIDS in the 80’s and 90’s; the social and cultural anthropological fight against Ebola (and Marburg) fever epidemics; the 2003 SARS outbreak; flu pandemics (H1N1 and H5N1); lay strategic approaches to the 2009 A/H1N1 flu in France. Added to these are three transversal analyses: analysis of mechanisms and multiple factors capable of explaining the emergence (or non-emergence) of problems normally falling under the domain of public health, particularly that of “society” as well as experts and politicians in the definition and hierarchization of emerging problems; focusing on the principle theoretical models developed by the social sciences to elucidate “laymen’s” (as opposed to experts’) perception of risk; an historical and anthropological-based consideration of the limits of popular participation in preventive and combative measures against infection, especially in the fight against resistance and in the “acceptability” of flu vaccination. The outbreak of the A/H1N1 flu pandemic of 2009 in fact points up these limits, and confirms the pertinence of this report. Though little-explored here due to lack of adequate perspective, this should be the subject of critical analysis in the near future.

Published in: Proceedings of the Royal Society of London, ser. B.

A daring research and training strategy for more effective assistance in the management of emerging infectious diseases (EIDs).

Priority recommendations

Interdisciplinary approach

An indispensible principle in the fight against EIDs to be promoted in research, analysis, risk management, and action, and which should become part of official public health policy. EIDs is synonymous with lack of knowledge and an area of great uncertainty. It is thus urgent that research and training be closely connected, as well as research and action, to make possible a more global understanding of this phenomenon, and to generate more open and innovative proposals.

Innovative organisation

Creation of a permanent monitoring body of experts capable of analyzing, interpreting and advising risk managers “in real time” on any and all EIDs. Accorded the necessary financial and human means, its mission will be to interpret new information, to synthesize essential experimental data, and to conduct a critical analysis of actions carried out, to coordinate an innovative organisational structure founded on multidisciplinary networking, constantly active and reactive; to share information with authorities in other fields of security; industry, military, aviation, nuclear energy... in order to propose new avenues of research and action; and to produce an annual status assessment of the battle against EIDs. Public reporting on its activities should help sensitize both professionals and laymen to the risk of EIDs.

Detailed recommendations

For integrated, innovative research:

- Develop prospective descriptive research on EIDs using clinical-biological and socio-ecological models which view the system with a bigger picture.
- Achieve a better understanding of the role of host species, reservoirs and/or vectors in emergence and its transmissibility to human.
- Prompt international scientific cooperation on EIDs, particularly in tropical regions where French overseas territories are located, or those with a high level of migration toward continental France.
- Foster the use of mathematical and computerized modeling to better understand transmission, and which take into account the complexity of the mechanisms involved and the diverse scales of emergence.
- Improve biomedical research on EIDs: infectious agents (particularly Class 3 and 4) and diseases, prevention and treatment, with the setting up of epidemiology-clinical cohorts of EIDs-infected patients coupled with biological samples.

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