



What is surveillance?

Health surveillance is the ongoing systematic collection, analysis and interpretation of health data essential for planning, implementing, and evaluating public health activities, closely integrated with timely dissemination of the data **to enable effective and efficient action to be taken to prevent and control disease.** (This draws on the CDC and WHO definitions.)

Surveillance ranges from compulsory notifiable diseases, specific disease registries (population- or hospital-based), continuous or repeated surveys of representative samples of the population, to aggregate data for recording trends on consumption patterns and economic activity.

How are health surveillance data used?

Surveillance may be used to:

- recognize cases or clusters of cases to **trigger interventions** to prevent transmission or reduce morbidity and mortality (includes the special case in which surveillance at the national level is required to recognize multi-state clusters);
- **identify new health problems** and emerging diseases;
- **assess public health impact** of health events or determine and measure trends;
- **measure causal factors in disease (e.g., risk factors) to initiate actions to prevent the onset of disease;**
- demonstrate the need for intervention programs and resources, and **allocate resources** during health planning;
- **monitor effectiveness and evaluate the impact** of prevention and control measures, intervention strategies, and health policy changes;
- **identify high-risk population groups or geographic areas** to target interventions and guide analytic studies;
- provide **data for research**, and develop hypotheses that lead to analytic studies about risk factors for disease causation, propagation or progression;
- **measure progress** toward Millennium Development Goals, or other project or program goals, including PRSP (Poverty Reduction Strategy Paper) targets.

At the local level, surveillance triggers basic public health **investigations** of disease outbreaks and **specific control activities** predominately for infectious diseases and environmental hazards. The main national level activities are: **measuring** trends in risk factors and disease; health **planning; monitoring** the **effectiveness** of specific interventions; conducting more complicated **analysis** to determine risk factors; and providing technical assistance. At intermediate levels (state, province, etc.) public health agencies typically share both perspectives.

Why invest in surveillance?

Relatively small investments can be very effective in reducing death, disease, and disability. Surveillance can make the health system more effective and efficient, and better able to **control devastating epidemics.** It can lead to early detection of local epidemics when control is more effective, less costly, and involves less loss of life. In addition to their health impact, epidemics can have a costly impact on productivity and other aspects of the economy: the 1991 cholera epidemic in Peru involved a total loss of \$770 million (primarily in the tourism and seafood industries), and the plague epidemic in India is estimated to have cost the country \$1.7 billion.

Borders are ineffective in containing diseases (the 1991 cholera epidemic eventually spread throughout Latin America), so surveillance and timely dissemination of information are wise investments for countries in which an epidemic is or might be occurring, as well as countries to which it might spread.

Surveillance is also important for **controlling and preventing endemic diseases** that reduce productivity and can be costly to manage. Good surveillance systems permit early identification of diseases such as TB and syphilis that can be cured easily with low-cost treatments, combined with other public health actions. Treatment of chronic non-communicable diseases, such as heart disease and diabetes and their sequelae, is costly, so prevention is a key strategy. Prevention and control of these diseases require surveillance of associated behaviors and risk factors (e.g. smoking, physical inactivity, obesity) and actions to promote the desired changes and risk reductions.

Scarce resources for health make it essential to **evaluate interventions and target resources**, so that

their contribution is optimized, compared to other possible interventions. Surveillance can provide useful information to identify populations at greatest risk where intervention may help most, and to gauge the effectiveness of interventions.

The scope of surveillance

The scope of surveillance is broad, from early warning systems for rapid response in the case of communicable diseases to planned response in the case of non-communicable diseases, where the lag time between exposure and disease is longer than for communicable diseases. Most countries have laws or regulations on mandatory reporting of a list of conditions determined by each country, primarily communicable diseases such as childhood vaccine-preventable diseases (polio, measles, tetanus, and diphtheria), TB, hepatitis, meningitis, and leprosy. Reporting may be required also for non-communicable conditions, such as maternal deaths, injuries, and occupational and environmental diseases such as pesticide poisoning. Mandatory reporting of specific conditions is a subset of surveillance. International regulations (which are being revised) currently require reporting of three diseases to WHO: plague; yellow fever; and cholera.

A key principle is to **include only conditions for which surveillance can effectively lead to prevention**. Another important principle is that surveillance systems need to reflect the overall disease burden of the community. Other criteria for selecting diseases include: total number of cases, incidence and prevalence; indices of severity (e.g., the case-fatality ratio); mortality rate and premature mortality; an index of lost productivity (e.g., bed-disability days); medical costs; preventability; epidemic potential; and information gaps on new diseases.

Surveillance can collect data on any element of the disease causal chain—behavioral risk factors, preventive actions (vaccinations, pap smears), cases and program or treatment costs. The scope of a surveillance system is constrained by the available human and financial resources.

Developing and expanding a surveillance system

The following table presents a possible scheme for developing a surveillance system. The *minimal list* of diseases is a starting point. Diseases should be added as the system evolves and resources become available. The table suggests a *second line* of diseases, but these will

Scheme for developing and expanding mandatory surveillance reporting

	Minimal list	Second line	Third line
Internationally required*	Cholera Yellow fever Plague		
Vaccine preventable	Polio** Measles Tetanus	Diphtheria Pertussis	Rubella Chickenpox Mumps
Communicable	TB	Meningitis Syphilis HIV/AIDS	Hepatitis Nosocomial infections Gonorrhea/Urethritis Food borne pathogens
Non-communicable			Risk factors (behavioral and physiological) which predict major diseases Pesticide poisoning Injuries Specific disease incidence
In endemic areas	Malaria Leprosy Onchocerciasis* (river blindness) Dracunculiasis* (guinea worm)	Dengue – especially hemorrhagic Ebola/hemorrhagic fevers Rabies	Encephalitis
Vital statistics	Sentinel sites & sample registration	Complete coverage	Valid cause of death

Source: World Bank, The Public Health Surveillance Toolkit

* The new International Health Regulations (2005) do not limit required reporting to these 3 diseases nor define what diseases must be reported. Instead they "... require States to notify WHO of all events that may constitute a public health emergency of international concern and to respond to requests for verification of information regarding such events."

**Targeted for eradication

depend greatly on a country's public health priorities, its disease burden, and the use of the data for intervention. A key principle of surveillance is that it is information for action. In some countries (e.g., Eastern Europe/Central Asia) non-communicable diseases are a large part of the disease burden, making risk factor surveillance even more important than tracking some specified diseases. A well-developed system can include dozens of conditions for surveillance—*third line*.

Developing a surveillance system should build on success. It is best to start slowly, and demonstrate effectiveness, which builds support among those who report and use data and those who allocate resources. Being too ambitious initially may undermine enthusiasm for continued effort and be destructive.

Mandatory disease notification is the primary method of collecting timely disease information particularly for communicable diseases. Other surveillance methods include: sentinel surveillance sites; periodic or ongoing surveys; reporting by laboratories; special registers (e.g., cancer); and secondary analysis of datasets. Depending on circumstances, one or more of these methods may be the best choice.

Surveillance for **emerging infections** such as SARS and avian influenza is an area that is evolving and challenging public health systems. For SARS and pandemic influenza, early warning systems for human clusters of severe pneumonia could permit the rapid containment of new cases. Syndromic surveillance of fever clusters is another approach to identifying outbreaks of emerging infections.

Vital statistics are the foundation of health information and "the single most important addition that developing countries can make to their existing surveillance system" (White and McDonnell in Teutsch and Churchill 2000). Accurate records of all births and of deaths by cause are invaluable for monitoring trends, estimating the

magnitude and understanding the distribution of conditions, and for tracking infant and maternal mortality. Electronic systems for reporting vital data are making this type of surveillance more timely and effective. Local health care providers can help ensure that births and deaths (by cause) are registered. There should be no fees for registering births and deaths. Incentives (requiring death certificates for burial, birth certificates for school enrollment and laws requiring registration) can improve vital statistic coverage.

Integrated disease surveillance is an effective, efficient and sustainable approach to strengthen national capacity for surveillance and response to communicable diseases. Surveillance activities for different diseases involve similar functions (detection, reporting, analysis and interpretation, feedback, action) and often use the same structures, processes and personnel. Yet in many countries surveillance is funded and managed by different independent control programs. An integrated approach aims to establish a well coordinated, action oriented system that looks for opportunities to integrate functions where appropriate, maximize synergies, and build on successful initiatives. Where possible, countries should use a common reporting form, a single data entry system for multiple diseases, and common communication channels. Training and supervision should be integrated, a common feedback bulletin can be used, and computers and vehicles etc can be shared. Integrating surveillance for communicable and non-communicable diseases faces serious methodological issues: for example, different data collection methods are usually needed for CDs and NCD risk factors, but there is good potential for integrating the other aspects of surveillance.

DO's and DON'Ts

- **DO fully evaluate the existing system** as part of project preparation or sector work to make things easier later.

Factors that influence effectiveness of surveillance systems

Factor or Element	Effective:	Ineffective:
Number of conditions	Fewer	Too many
Amount of information per case	Little	Too much
Burden on reporter	Small	Too complex & burdensome
Decision makers' interest in surveillance data	High	Low
Goals for surveillance	Clear and supported	May never have been clear
Reporting strategy for serious but common conditions	Enough information to meet goals & make decisions	Complete reporting
Usefulness of data locally	High	Low
Use is limited to analysis of data & archiving	No, data are well used	Limited use of data
Usefulness to decision makers for prevention action	High	Low

Involve national stakeholders in a team-based decision making process to **determine the most appropriate and suitable surveillance model**. This will help to ensure better data for decision-making, and establish ownership and commitment of key project implementers.

- **DO carefully select a manageable, limited list of disease and risk factors for surveillance.** Don't include too many conditions for mandatory notification. Additional diseases and factors can be added once the system is running well and the data are being used effectively. Give priority to collecting and using vital statistics. **Design a flexible system that can evolve** and adapt to changing circumstances and country needs.
- **DO** set up a robust and accurate data transmission system, that allows data to be easily queried and corrected.
- **DO** ensure that the actors have a strong sense of ownership of the data and that core aggregate data on key indicators are transmitted and stored for use.
- **DO build local ownership and commitment to the project.** It is important to visit and engage sites outside of the national capital. Involve local and intermediate levels early on in decision-making (on design, roles and responsibilities) to ensure more successful outcomes. Include national professional associations and sectors other than health, which may also benefit from a good surveillance system (tourism, agriculture, treasury, and so on). Periodic dissemination of information to the press, and involving one or two health-related journalists might also bring advantages in promoting the project. Emphasize technical aspects and also the process as part of the strategy for building ownership.
- **DO involve the private sector and the community** in disease surveillance. **DON'T** rely entirely on the public health system as the sole source of information.
- **DO create a detailed design of the investments** for each level of the system. Pay close attention to what should be done at national, intermediate, and municipal levels of the system. **Clearly define the roles and responsibilities** of the three levels of the surveillance system. Avoid task overlap.
- **DO as much design as possible while planning investments.** A detailed implementation plan that identifies the task, its objectives, the location, starting date and ending date, the staff/entity responsible for implementation, a description of the main steps, unit cost and procurement procedures, and outputs is an important management tool for implementers and funders.
- **DO ensure that surveillance guidelines** specify "what and how, when, who and where" to survey. Guidelines should be revised by national health surveillance officials, externally reviewed, and the final product approved by key policy decision-makers.
- **DO** include the **training** necessary to develop competent and qualified personnel, who are

absolutely fundamental to effective surveillance. Give high priority to training and capacity building.

- **DO involve all stakeholders** in the design of the system to help ensure that the information collected is used for making decisions on disease prevention and control.
- **DO ensure necessary laboratory support for surveillance.** Make sure that capacity and systems are in place to provide timely, reliable confirmation of suspected cases to those who will make decisions and take action.

Key reference

The Public Health Surveillance Toolkit, 80 pages of practical, specific, detailed information, and fundamental concepts in public health surveillance, that draws on the experience of World Bank staff, technical experts from PAHO and the CDC, and WHO references. Also provides selected key references and websites for additional information, and global and regional information on outbreaks and other surveillance data.
<http://www.worldbank.org/hnp> > Tools & Guidelines

Other useful references

Teutsch, S. M. and R. E. Churchill, eds. 2000. Principles and Practice of Public Health Surveillance, 2nd edition. New York: OUP.

Halperin, W., E. L. Baker, P. R. Monson, eds. 1992. Public Health Surveillance. New York: Van Nostrand Rienhold.

<http://www.who.int/csr> - WHO's Communicable Disease Surveillance website

<http://www.who.int/csr/resources/publications/csrpublications/en/index19.html> for key WHO documents on surveillance:

- Protocol for the Assessment of National Communicable Disease Surveillance and Response Systems: Guidelines for Assessment Teams
 - WHO recommended surveillance standards, 2nd edition
<http://www.who.int/ncd/surveillance> site, especially see:
 - WHO Global NCD InfoBase
 - SuRF (Surveillance of Risk Factors) Report
- WHO STEPwise approach to Surveillance of risk factors associated with non-communicable diseases (STEPS)

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Expanded versions of the "at a glance" series, with links to resources and more information, are available on the World Bank Health, Nutrition and Population web site: www.worldbank.org/hnp