Public Health Agency
Assistant Agency for Preventive Health
Surveillance and Data Management Unit

وزارة الصحة
Ministry of Health

Public Health Surveillance

Technical Guidelines

First Edition

2017

Supervisor

Assistant Deputy Minister for Preventive Health

Dr. Abdullah M Assiri

Prepared by

Dr. Fahad M AlSwaidi

Dr. Abdulhameed M Kashkary
Dr. Muhrah M Al Alawi
Ms. Mai A Jamadar
Mr. Turki A AlGarni
Ms. Noha Nahed Al Rahmani

SDMU
Surveillance and Data Mangement Unit
وحـدة المراقبة الوبائية ومعالجة البيانات

SDMU

Surveillance and Data Mangement Unit

وحـدة المراقبة الوبائية ومعالجة البيانات

ⓒ وزارة الصحة ، ١٤٣٨هـ

فهرسة مكتبة الملك فهد الوطنية أثناء النشر

عسيري ، عبدالله بن مفرح نظام المراقية الوبائية (الدليل الفني).
عبدالله بن مفرح عسيري
؛ فهد بن محمد السويدي ؛ مي بنت عبدالقادر جمدار ؛ عبدالحميد بن محمد كشقري ؛ مهرة بنت منسي العلوي .- الرياض ، ١٤٣٨هـ

٧٠ ص ؛ ..سم

ردمك: ٣-٢٣-٨٢٠٩-٦٠٣-٩٧٨

ديوي ٦١٤,٥ ١٤٣٨/١٠٣٦٤

رقم الإيداع: ١٤٣٨/١٠٣٦٤
ردمك: ٣-٢٣-٨٢٠٩-٦٠٣-٩٧٨

إذن الطباعة من وزارة الثقافة والإعلام
رقم: ٠٣٠٨٢٠١٧٠٠٠٤١٩٢
تاريخ: ٢٠١٧/٨/٤

INTRODUCTION

Public health surveillance is the process of collecting, analyzing, arranging and discussing data on diseases and health events, and issuing reports containing recommendations that contribute to control and prevention, and sharing this information with relevant persons and entities.

In addition to preventing and controlling diseases, injuries and other health events, and understanding their implications, the public health surveillance system helps diagnose and prioritize many public health issues and identify indicators that assist in evaluating their programs and is, therefore, one of the most important planning and development tools in health affairs in general.

This guide is an important step towards strengthening and standardizing the surveillance systems of the preventive programs in MOH to produce reliable health indicators and reports.

Assistant Deputy Minister for
Preventive Health
Dr. Abdullah M Assiri

PREFACE

This guide displays in two main sections a description of the purpose, structure and operating mechanism of the public health surveillance system. The second section describes in detail the most important characteristics of the ideal public health surveillance system. It also contains simplified tools that help staff in the public health surveillance system understand the elements and characteristics of the surveillance and how to evaluate them easily.

The information in this guide is adapted from the most important sources of public health surveillance expertise in the world, the Centers for Disease Control in the United States of America and Europe. The information was arranged in a brief and concise manner to make it easy for the public health surveillance staff to read and understand its content.

Head of Surveillance and Data Management Unit

Dr. Fahad M Alswaidi

Contents

Definitions

Public Health Surveillance: the ongoing systematic data collection, analysis, consolidation, interpretation and dissemination of solutions that help in control and prevention of diseases and health events.

Passive Surveillance: it relies on doctors, laboratories, hospital staff or other sources in the health system to initiate and report cases to the Ministry of Health according to the reporting guidelines.

Active surveillance: it relies on the initiative of public health officials to contact doctors, laboratories, hospital staff or other sources of the surveillance system and urge them to report on the required cases.

Sentinel Surveillance: based on reports of specific disease or diseases by a select group of doctors, hospitals, laboratories and other sources of control in a specific area and for a specific period.

Possible case: the definition of a possible case depends on the presence of only clinical criteria, which are, the specific symptoms and vital signs of the disease.

Probable case: is the possible case definition in addition to the epidemiological criteria and initial laboratory tests if there is any.

Confirmed case: the definition of the confirmed case depends on all possible and probable case criteria as well as confirmatory laboratory tests.

The sensitivity of the public health surveillance system: the ability of the system to detect the positive cases and reduce the false negative cases.

Positive Predictive Value of the Public Health Surveillance System: the ability of the system to detect positive cases and reduce false positives cases.

The timeliness: the time between the appearance of the case until it is registered in the department responsible for verifying and implementing the preventive procedures.

Data representation: the percentage of population covered by the public health surveillance system on the total population of the specific geographical area.

Part I

Purpose, Structure and Operating Mechanism of The Public Health Surveillance System

Introduction

Before investigating the attributes of the surveillance system, there should be description of the purpose and operation of the system. The purpose of the system indicates why the system exists, whereas its objectives relate to how the data are used for public health action.

The health service is usually organized at three levels. The peripheral level consists of primary health care centers (PHCs) staffed by clinical officers, nurses and public health officers who provide health care services to local communities. At the regional level there is a district hospital providing both in-patient and outpatient services. In addition, there is a regional public health team responsible for disease surveillance and control. At the national level there are number of referral hospitals, laboratories and the national public health programs as part of MOH headquarters. Ideally, the national disease surveillance and control is a function of the public health headquarters which reports ultimately to the Minister and other stakeholders. The private sector is growing especially in urban areas and became important source of the surveillance system, therefore it should be considered as important partner when establishing new surveillance system.

The specific terms of reference in designing surveillance system are to:

- develop surveillance objectives for the disease.
- design a surveillance system, which will achieve the stated objectives.

Reviewing the key features of the disease and its public health importance (available data) will help to formulate clear objectives for the surveillance system. The next step is to design a surveillance system specifically to achieve the objectives.

KEY ISSUES IN DEVELOPING THE SURVEILLANCE SYSTEM:

- The public health importance of the disease
- The objectives of the surveillance system
- The surveillance case definition
- The indicators required for decision making
- The minimum data that to be collected
- The sources of data and frequency of reporting.

Public Health Importance of the Disease

- mortality

Public Health Importance of the Disease

- mortality
- morbidity
- cost / socio-economic impact
- preventability

Objectives of the Surveillance System (SMART)

(Specific, Measurable, Action orientated, Realistic, Time frame)

- monitor trends and detect changes (outbreak detection) for intervention
- evaluation of a preventive program
- health care planning projection
- disease elimination or eradication
- generate hypotheses about transmission
- collect case information for further studies

Surveillance Case Definition

The case definition depends on the type of disease, its transmission and the resources available to diagnose it. Emerging diseases (such as the Middle East Respiratory Syndrome), emitted and rare, are initially defined based on clinical criteria only, because of the limited information on transport routes and risk factors, as well as the lack of laboratory diagnosis because it is unavailable or its high price.

- **Case definition criteria:**
  1. Clinical criteria: symptoms and vital signs.
  2. Epidemiological criteria: methods of disease transmission and risk factors.
  3. Laboratory confirmation: laboratory diagnosis.
- **Case definition Levels:**
  1. Possible case: It is based on clinical information only.
  2. Probable case: It is based on clinical and epidemiological information.
  3. Confirmed case: It is based on clinical, epidemiological information and laboratory confirmation.
- **Case investigation and case confirmation training:**

Prior to adopting the case definition, a sufficient number of cases investigations must be carried out to ascertain the pathways of transmission and risk factors in the target population. It is very important to work closely with health workers in hospitals and other treatment facilities to agree on clinical information and link it to the epidemiological information to eventually arrive at the appropriate definition of the case according to the available means.

Data indicators required

- numbers, rates
- mortality, morbidity
- case management

dataset required

- variables needed
- numerator, denominators

data sources

- primary care providers
- screening (opportunistic versus systematic)
- hospitals and clinics

- laboratory
- registers (vital registrations and statistics)
- other sources (community, surveys, insurance companies etc)

data collection

- active / passive
- data collection instrument
- aggregated / individual
- confidentiality
- data security
- sample (sentinel) versus comprehensive

data flow

- reporting mechanism (paper, telephone, fax, electronic)
- statutory / voluntary
- frequency of returns
- zero reporting
- to which levels of the health system

data analysis

- at which level of the health system
- frequency
- production of indicators
- threshold (departure from expected)

Information

- interpretation
- information flow
- communication methods
- frequency of reports / queries / access to raw data
- Target audience (to which levels of the health system):
  - . decision makers / service providers
  - . data providers (feedback)
  - . media / public

Action (as an outcome of the system)

- public health intervention
- change in service provision
- survey / research
- legislation / regulation

Evaluation

- Is the system useful?
- Has it achieved the surveillance objectives?

Awareness and good knowledge of the components of the surveillance system are the most important factors in the success of the system to achieve its objectives. The awareness of public health surveillance personnel of any disease can be assessed by measuring their knowledge of the above elements which are summarized in Table 1.

A useful and effective epidemiological surveillance system is achieved by the following ideal characteristics and requirements, which will be discussed in detail in the next part of this guidelines.

Criteria for the ideal surveillance system

- Simple
- Valid data
- Representative
- Sensitive
- Acceptable
- Provides feedback
- Complete data
- Timeliness
- Flexible
- Predictive value positive
- Motivated workers

Part II

Characteristics of the Public Health Surveillance System

Introduction:

An assessment of the usefulness of a public health surveillance system should begin with a review of the objectives of the system and should consider the system›s effect on policy decisions and disease-control programs. Depending on the objectives of a particular surveillance system, the system might be considered useful if it satisfactorily addresses at least one of the following questions. Does the system:

- detect diseases, injuries, or adverse or protective exposures of public importance in a timely way to permit accurate diagnosis or identification, prevention or treatment, and handling of contacts when appropriate?
- provide estimates of the magnitude of morbidity and mortality related to the health-related event under surveillance, including the identification of factors associated with the event?
- detect trends that signal changes in the occurrence of disease, injury, or adverse or protective exposure, including detection of epidemics (or outbreaks)?
- permit assessment of the effect of prevention and control programs?
- lead to improved clinical, behavioral, social, policy, or environmental practices? or
- stimulate research intended to lead to prevention or control?

Measuring the effectiveness of an the surveillance system can be carried out by means of a systematic survey or simplified review of both available data from the system or users of the system, as available.

Any of the characteristics of an epidemiological surveillance system can be influenced by the performance and effectiveness of the system. For example, increased sensitivity might afford a greater opportunity for identifying outbreaks and understanding the natural course of an adverse health-related event in the population under surveillance. Improved timeliness allows control and prevention activities to be initiated earlier. Increased predictive value positive enables public health officials to more accurately focus resources for control and prevention measures. A representative surveillance system will better characterize the epidemiologic characteristics of a health-related event in a defined population. Public health surveillance systems that are simple, flexible, acceptable, and stable will likely be more complete and useful for public health action.

CHARACTERISTICS OF SURVEILLANCE SYSTEM AND THEIR EVALUATION

Simplicity

Explanation:

A public health system is considered simplified and decent when its operations can be conveniently performed and its configuration is simple. Alongside, these surveillance systems can easily manage to fulfill their organizational objectives with simplicity.

Methodology:

A surveillance system can be evaluated in terms of simplicity or complexity levels through its flow chart data and the surveillance system's lines of response. Therefore, this guidelines also comprises of an easy flow chart appropriate for generic surveillance system (Figure 1).

A system's simplified nature can be understood by means of the following criteria:

- integration level with other several systems.
- data type and amount required for developing the health-related event which implies that the case definition has been met.
- type and amount of further data on cases like demography, behavior and exposure information for the health-related event.

  how many organizations involved in receiving case reports.
- data gathering methods, time taken for the data gathering, number and type of reporting sources.
- follow-up capacity required for upgrading case data.
- data management methods inclusive of keeping a back-up of data, time taken for data transfer, edit, save and output.
- data analysis and distribution methods inclusive of time for data preparation for distribution.
- time spent for system's maintenance.
- prerequisites of personnel training.

Discussion:

The efficacy of a public health surveillance system in terms of design simplicity can be helpful and it also includes a case definition which can be easily implemented, i.e. the case can be conveniently confirmed where the case is recognized by the person who can evaluate it and then he can further utilize the information. However, the complexity of a system can be judged by means of inclusion of the following components:

- case confirmation through specific or follow-up laboratory tests,
- case investigation by means of visiting residence, investigating contacts via public health personnel for the sake of accumulating meticulous information;
- multiple reporting levels such as the healthcare provider initiates with the case reports, by first making appropriate diagnosis, then passing over the other region and country's health departments earlier than it can move directly to MOH headquarters;
- the data collection and interpretation are made by means of exclusive training of related systems' staff.

Therefore, it can be said that simplicity impacts the resources necessitated for system operation as it has a close relationship with appropriateness and recognition.

Flexibility

Explanation:

A public health surveillance system's flexibility can be judged in terms of its ability to adapt to changing information needs or operating conditions with little additional time, personnel, or allocated funds.

Moreover, flexibility in systems can be judged through its ability of transforming case definitions, transforming technology, addition of new health-related events, and transformations in reporting sources or funding. Likewise, the system's integration becomes more convenient with other systems with its standard data formats like including electronic data interchange.

Methodology:

flexibility can be evaluated through the retrospective analysis of how the system responded to a new demand.

Discussion:

The public health surveillance system is transformed in such a capacity that it easily adapts another disease, reviewed case definition, supplementary data sources, transformations in funding, new information technology, and health-related incident. The investigation of the structure, design and operations of a system is possible and easily conducted when it is needed. The flexibility of simpler systems can be easily viewed as these comprise of lesser parts for modification when there is a transformation in the information needs or working conditions while implementing the system.

Data Quality

Explanation:

The completeness and validity of the data are the determinants of the data quality of the public health surveillance system.

Methodology: Data quality can be conveniently estimated or analyzed in terms of the rate of blank responses to each variable in the forms of surveillance. The rate of these responses will be less in rate if the data is of high quality and vice versa. There may be a need of particular survey of the completeness and validity of the data when it has to evaluate the system entirely. A contrast can be drawn among data values of the surveillance system and the true values from another source; like, specific record linkage, sampled data evaluation, patient interview. Another way to evaluate data quality is to calculate the sensitivity and predictive value positive of the surveillance data.

The diagnostic and screening tests' presentation can also be impacted through data quality like the case definition when it comes to a health-related incident, simplified and easy-to-understand electronic surveillance forms or the hardcopy, training quality, and regulation of people involved in the completion of such

surveillance forms along with the careful data management. Such factors of the public health surveillance system can be reassessed indirectly for estimating data quality.

Discussion: Majority of the surveillance systems are dependent on simplified case counts as data accumulation is made over the features of demography of affected people, information regarding the health-related event, and the probable risk factors. Therefore, the data quality rests over the completeness and validity.

Data quality is linked with the acceptability and representativeness of public health surveillance system where the participants can easily understand and utilize the system along with high quality data. Further, the health-related event under surveillance can be easily depicted through the system.

Acceptability

Explanation: Acceptability implies the eagerness/willingness of people and organizations to participate in the surveillance system.

Methodology: Acceptability implies the participants of the sponsoring agency who are keen for system's various functions along with other people external to the sponsoring organization i.e. data reporting people that utilize the system. In evaluating acceptability, interaction points among the participants and the system needs to be taken into account, as demonstrated in the Figure 1, which briefs the reporting cases and health-related events.

The acceptability can be viewed in quantitative measures as:

- Completeness of report forms.
- Timeliness of data reporting.
- Participation rate of agency or subject and its pace of attainment is considered such as high or low.
- When the system comprises of interviews, there are rates of question refusal and interview completion.
- Reporting rate of physician, laboratory or hospital.

The surveillance report forms can be reviewed to evaluate some of the above measures while other measures need conduction of particular studies.

Discussion:

The eagerness of people is seen in acceptability i.e. a great subjective feature upon which the public health surveillance system requires consistency, completeness, aptness and timeliness in the data. There are several elements that impact a specific system to a large extent. These include:

- significance of the health-related event in terms of public health,
- appreciation of the system to the person›s contribution,
- aggregate data distribution back to interested bodies and reporting resources,
- system reaction to recommendations or opinions;
- ease of data reporting and its related costs;
- time relative load over time accessible;
- system's capability of security, protection and discretion;
- data accumulation and case reporting status prerequisites;
- legislative declaration of discretion and security.

Sensitivity

Explanation: There are two levels on which the sensitivity of a surveillance system relies on. Initially, at the level of case reportage, sensitivity is defined as the percentage of disease or any other proceeding associated to health that the surveillance system identifies. According to the second level, it has the tendency to recognize outbreaks that also comprises of the capability to notice variations in the number of cases by time.

Methodology:

The factors influencing the measurement of the sensitivity of public health surveillance are

- the population under surveillance who suffers from different diseases or other health-related events;

- cases of certain health-related events lie in the category of medical care, facilitated by the service of laboratory testing, otherwise are noticed by the organizations who are accountable for reporting necessities;
- diagnosis/determining the health-related event portrays the skill of the health care workers and the sensitivity of the screening and the diagnostic tests (i.e. case definition); and the system will be informed about the case.

With the help of analogy to public health surveillance systems that is not a conventional disease care provider model; it is possible to extend these situations. For instance, the factors influencing the sensitivity of a telephone reliant on the surveillance system of morbidity or risk factor are:

- The number of individuals, who owe telephones, stay at home at the time of call making, and who actively participate.
- The capability of the individuals to completely understand the queries and detecting their status; as well as
- The respondent's inclination of reporting their status.

The system and the resources available for assessing sensitivity are accountable for the extent to which these conditions are explored. The chief focus is on evaluating sensitivity with the thought that majority of the cases reported are accurately categorized so as to evaluate the proportion of the overall reported cases in the population within surveillance and being identified via system, characterized by A/(A+C) in this guideline (Table 2).

The identification of outbreaks is extremely significant when surveillance of vaccine-preventable diseases takes place. The other health-related events can take advantage of the practices that have been suggesting for enhancing sensitivity of recording vaccine-preventable diseases. For instance, the following features can enhance the sensitivity of a system:

- carrying out active surveillance (which is, communicating with all the suppliers and organizations who are accountable for reporting cases);

- applying external standards (or other surveillance indicators) with the motive to increase the quality of case reporting;
- detecting imported cases;
- following up the reported, investigated, and ruled out cases of suspected disease.
- keeping an eye on the diagnostic effort (for instance, follow up the submission of laboratory requirements for diagnostic testing); as well as
- tracking the transmission of the agent (virus or bacterium…), which causes the disease.

In order to improve the tendency for a public health surveillance system to identify outbreaks (or other alterations in incidence and prevalence), the system should incorporate the detailed diagnostic tests. For instance, the surveillance system in Saudi Arabia tends to identify the outbreaks through the utilization of the molecular subtyping in the surveillance of MERS CoV infections otherwise they never were identified.

The measurement of the sensitivity of the surveillance (Table 2) needs an a) assortment or to attain external data of the system with the intention to evaluate the actual frequency of the condition in the population under surveillance and b) confirmation of the data assorted via the system. The medical records and registries are examples of data sources utilized to evaluate the sensitivity of health information or public health surveillance systems. Moreover, with the motive to assess sensitivity, the estimates of the overall cases in the population under surveillance through capture-recapture techniques can be used.

The sensitivity of the public health surveillance system can be sufficiently assessed by computing multiple measurements of the attribute. For instance, it is possible to evaluate sensitivity for the system›s data fields, for each data source or for combinations of data sources, for specific conditions under surveillance, or for each of several years. The capacities of sensitivity for combinations of the system›s data sources can be illustrated with the help of Venn diagram.

Discussion:

One of the most helpful ways for evaluating sensitivity measurements for a public health surveillance system is literature review. For the evaluation of the sensitivity of every data source that also involves combinations of data sources, it is significant to ensure the removal of a present data source or the incorporation of a new data source as it would influence the entire surveillance outcomes.

As long as the sensitivity remains reasonably constant in general, a public health surveillance system that does not have a high sensitivity is pretty much beneficial for monitoring trends. Whenever the alterations in the occurrence of the health-related event take place and are monitored then the questions regarding the sensitivity in surveillance systems arise. There are some situations such as sharp awareness of a health-related event, presence of new diagnostic tests, and modifications in the approach of carrying out surveillance, cause alterations in the sensitivity. A primary step in the outbreak inquiries is the search for such kind of «artifacts».

Predictive Value Positive

Explanation: Predictive value positive (PVP) is defined as the percentage of recorded cases that really possess the health-related event under surveillance.

Methodology: Different thoughts about how well is the performance of the system is accomplished from the assessment of sensitivity and of PVP. It is mandatory to attain PVP whenever sensitivity has been assessed on the basis of the goals of the public health surveillance system. In this guidelines, PVP is demonstrated through A/ (A+B) (Table 2).

When it comes to evaluate PVP, the initial concern is the validation of cases reported by the surveillance system. There are two levels on which the influence of PVP on the utilization of public health resources can be measured. In light of the case recognition level, the quantity of the resources utilized for case inquiries are influenced by PVP. For instance, a public health nurse has to investigate

every reported case of type A hepatitis and at risk contacts are referred for prophylactic treatment. Misapplied resources can be the result if a surveillance system possessing low PVP and numerous «false-positive» case reports.

At the epidemic identification level, an inappropriate outbreak investigation is carried out due to a high rate of erroneous case reports. Consequently, PVP can be assessed by the percentage of outbreaks recognized by the surveillance system that are actual outbreaks.

There is a need of documents of inquiries provoked by information attained via public health surveillance system for computing the PVP. At case identification level, the calculation of PVP is enabled due to the reportage of the number of case inquiries completed and the quantity of reported persons who actually had the health-related event under surveillance. At the outbreak identification level, the evaluation of PVP is enabled by the review of personnel activity reports, travel records, and telephone logbooks. On the other hand, a review of data external to the system (e.g., medical records) for various surveillance systems is mandatory so as to validate cases to compute PVP. The demonstrations of data sources that are utilized to obtain PVP of health information or public health surveillance systems comprises of medical records, registries, and death certificates.

It is mandatory to compute multiple measurements of the attribute in order to evaluate the PVP of the system sufficiently. For instance, the system›s data fields for each data source or multiple data sources, or either for particular health-related events are utilized for determining PVP.

Discussion:

The significance of PVP cannot be denied as a low value depicts that the non-cases may be examined, and epidemics can be recognized although they are fake; however, are referred as artifacts of the public health surveillance system (for instance. a «pseudo-outbreak»). Unnecessary interventions and falsely detected outbreaks can be encountered due to the false-positive reports and

can cause expensive inquiries and excessive distress in the population under surveillance. Lesser number of misallocated resources can occur because of a public health surveillance system with high PVP.

The sensitivity and specificity of the case definition (which is the screening and diagnostic tests for the health-related event) and the prevalence of the health-related event in the population under surveillance are portrayed by the PVP. Moreover, PVP can be enhanced by the good and clear communication amid the individuals who report cases and the receiving agency.

Representativeness

Explanation:

If the health-related event and its distribution in the population can be described by means of time, place and person then the public health surveillance system is representative.

Methodology:

In order to evaluate representativeness, the comparison of the characteristics of reported events to all the actual events should be carried out. There is no possibility to be aware about the latter information; however, it is possible to attain various judgment of the representativeness of surveillance data depending upon the information of:

- population characteristics, comprising of age, socioeconomic status, ways to access health care, and geographic location;
- clinical course of the disease or event (for instance, latency period, mode of transmission, and outcome [e.g., death, hospitalization, or disability]) and behavior of the disease;
- predominant medical approaches (such as locations of diagnostic tests and physician referral patterns); and
- Multifarious data sources (For instance, mortality rates so as to compare it with incidence data and laboratory reports for comparison with physician reports).

With the motive to determine representativeness, special researches are carried out so as to recognize a sample of all such cases. For instance, the systematic sample of injured persons was utilized for evaluation of the representativeness of a regional injury surveillance system. The main concern of the research was the assessment of statistical methods of population variables (age, sex, habitation, nature of injury, and hospital admittance) and made an inference that the capability of the surveillance system to accomplish its goals should not be influenced by the differences in the distribution of injuries in the system›s database and their distribution in the sampled data.

When it comes to health-related events under surveillance, the calculation of rates is mandatory for precise evaluation and interpretation of the data. The denominators that are utilized in these rate computations are attained from an entirely independent database monitored by another organization (the National Census Agency). In order to make sure a precise representation of the health-related events over time, place and person, it is extremely important to select a suitable denominator for the rate computation. For instance, numerators and denominators should be comparable across variables (e.g., race, age, habitation, or time period), and with the passage of time the source for the denominator should be stable for determining rate trends. Moreover, a focus should be on the choice of the standard population for the adjustment of rates.

Discussion:

If we want to generalize the outcomes from surveillance data to the population, the characteristics of the health-related event under surveillance must precisely portray the data from a public health surveillance system. These characteristics are in accordance with the time, place, and person. While examining the representativeness of a surveillance system, the most significant outcome encountered is the identification of population subgroups that might be systematically omitted from the reporting system via insufficient practices of

monitoring them. This evaluation procedure enables the alteration of data collection processes and precise projection of incidence of the health-related event in the target population.

It is extremely significant to know the strengths and restrictions of the system›s data as the groups that are at high risk are identified through the surveillance data along with targeting and evaluating the interventions. At any phase of the system, the errors and bias can be introduced. For instance, the cause behind case ascertainment (selection bias) is the changes in reporting approaches or either by discrimination in reporting methods through geographic location or via health-care providers. Misleading inferences regarding the health-related event under surveillance can be due to the differential reporting among population subdivisions

Timeliness

Explanation: Timeliness can be simply defined as the speed between steps in a public health surveillance system.

Methodology:

The guideline (Figure 2) comprises of the simplified example of the steps of a public health surveillance system. It is possible to evaluate the time interval connecting any two of these steps. The foremost interval that is the main concern is the quantity of time between the commencement of a health-related events and the reporting of that event to the public health agency that is accountable for introducing control and preventive methods. The time of this interval can be affected due to the factors involving the patient›s knowledge regarding symptoms; the patient›s acquisition of medical care, showing up at physician›s diagnosis or during submission of a laboratory test, showing the report of the laboratory test to the physician or to any public health agency, and public health agency is informed about event via physician. The other part of timeliness deals with the time needed for the recognition of trends, outbreaks, or effect of prevention measures and controls. The recognition procedure is affected by

the factors comprising of the severity and communicability of the health-related event, staffing of the responsible public health agency, and communication among involved health agencies and organizations. The most appropriate time interval can differ from the kind of health-related event under surveillance. The interval from the onset of symptoms or the date of exposure with acute or infectious diseases can be used. When it comes to chronic diseases, the elapsed time from diagnosis should be monitored instead of date of symptom onset.

Discussion: It is important to analyze the timeliness of a public health surveillance system in accordance with the availability of information to control a health-related event, involving immediate control efforts, prevention of ongoing exposure, or planning for a program. The requirement for rapidity of reaction in a surveillance system is reliant on the need of the health-related event under surveillance and the goals of that system. In case of notifiable infectious disease, like MERS CoV, reporting to public health department should be performed immediately after onset of the suspected symptoms because delay will definitely cause the existence of secondary and tertiary transmission. For infectious disease control, the degree of timeliness is crucial factor. Nevertheless, whenever a long duration of latency takes place between the exposure and appearance of disease, the rapid availability of exposure data is significant to provide a basis for interrupting and preventing exposures that lead to disease but not the rapid identification of the disease itself. For instance, children with risk of adverse health-related events due to high blood lead levels and no clinically apparent illness. The suggestions are to promote asymptomatic children with increased blood lead levels comprising of educational activities about prevention of lead poisoning and investigations along with handling the sources of lead exposure. Further, the public health agencies utilize the surveillance data to monitor the progress towards national and regional health goals.

Timeliness is promoted through the increased utilization of electronic data collection from reporting sources (e.g. health electronic surveillance system

(HESN)) through the Internet (a web-based system) as well as the electronic data interchanges by surveillance systems.

Stability

Explanation:

The meaning of stability is reliability (the ability to collect, manage, and provide data properly without failure) and availability (the ability to be operational when it is needed) of the public health surveillance system.

Methodology:

The system stability's methods comprise of:

- the number of spontaneous outages and down times for the system›s computer.
- the money invested on any repair of the system›s computer comprising of parts, service, time spent on the repair;
- the time percentage in which the system was functioning perfectly;
- the expected and actual time needed for the system for gathering or receiving data;
- the expected and actual time needed for the system for managing data such as transfer, entry, modifying, storage, and back-up of data; and
- the expected and actual time needed for the system to release data.

Discussion:

The stability of a public health surveillance system is affected by the absence of dedicated resources. For instance, reliability and availability are affected because of the workforce shortages. No matter what is the health-related event being monitored, the stable to control the disease and respond to performance to the viability of the surveillance system is crucial. The important public health action can be delayed or prevented by the unreliable and unavailable surveillance systems.

With the help of modeling procedures, a more formal evaluation of the system's

stability is possible. Nevertheless, the better practice to assess stability is based on the purpose and goals of the system.

The main surveillance attributes are summarized in Table 3. This summary table can be used as a tool to evaluate the general attributes or characteristics of the public health surveillance system.

TYPES OF NOTIFICATION IN THE SAUDI MINISTRY OF HEALTH (MOH)3

1.Immediate:

This is for class I diseases that need immediate action, notification is by fax or phone or electronically through HESN.

The Health Electronic Surveillance Network (HESN) is an electronic reporting system was developed for reporting infectious diseases. When the case is reported in HESN, the public health department in the region and the ministry of health headquarters can view it immediately to take the appropriate action.

2.Weekly:

This is for class II diseases which will be sent from the health units to the regional health affairs.

3.Monthly:

This includes all infectious diseases notified to the regional health affairs which in turn notify the deputy minister for public health.

4.Weekly zero reporting:

- All acute flaccid paralysis cases in children less than 15 years.
- All suspected measles, rubella and mumps cases.
- H1N1.

Notifications are sent from regions and other sectors to infectious disease directorate.

Notification to the decision makers in MOH:

- **Meningococcal meningitis, cholera, plague, yellow fever and poliomyelitis diseases:**

- Are notified to deputy minister for public health then to his Excellency deputy minister for health affairs.
- To his Excellency minister in occurrence of outbreaks.
- All infectious diseases are notified to his Excellency minister monthly.
- Any disease appears in epidemic is notified to his Excellency deputy minister for health affairs and to his Excellency minister.

The quarter report is notified to his Excellency minister, his Excellency deputy minister for health affairs, and the concerned people, and also the yearly report

References

All materials of this guidelines were adapted from the following references:

1. European Centre for Disease Prevention and Control (ECDC). European programme for intervention epidemiology training (EPIET). Available at: http://ecdc.europa.eu/en/epiet/Pages/HomeEpiet.aspx.
2. European Centre for Disease Prevention and Control (ECDC). Data quality monitoring and surveillance system evaluation – A handbook of methods and applications. Stockholm: ECDC; 2014.
3. Updated Guidelines for Evaluating Public Health Surveillance Systems. Recommendations from the Guidelines Working Group. MMWR Recommendations and Reports. July 50;2001 ,27(RR35–1:(13-.
4. Saudi Ministry of Health. Notification of infectious diseases Guidelines. Department of infectious diseases control. 6th Edition, Riyadh, 2016.

Appendices

Table 1. Descriptions of disease/health event surveillance (Summary).

Element	Descriptions	Applicable (%)
Surveillance objectives	1. Monitor trends of disease over time in order to assess the present situation and compare it across regions to control the disease and respond to outbreaks above certain warning thresholds and to facilitate evidence-based action. 2. Detect and monitor any multinational infectious disease outbreaks with respect to source, time, population and place in order to provide a rationale for public health action; 3. Contribute to the evaluation and monitoring of prevention and control programmes targeted at infectious disease surveillance in order to provide evidence for recommendations to strengthen and improve these programmes at the national level; 4. Identify population groups at risk and in need for targeted prevention measures; 5. Contribute to the assessment of the burden of the disease on the population, using such data as disease prevalence, complications, hospitalisation, and mortality; and 6. Generate hypotheses on (new) disease sources, modes of transmission and groups most at risk, and identify needs for research and development and for pilot projects.	

Case definitions	Case definitions for surveillance purposes are clinical criteria, laboratory criteria, and epidemiological link. 1. Possible: classification of cases is based on clinical criteria. Diseases for which cases can be reported as possible are vCJD, VTEC, influenza, polio, SARS, smallpox, tuberculosis. 2. Probable: classification of cases is based on clinical criteria, epidemiological link, and presumptive laboratory criteria. Diseases for which cases can be reported as probable include anthrax, botulism, brucellosis, hepatitis A, Legionnaires› disease, listeriosis, measles, meningococcal infection, mumps, pertussis, plague, rabies, rubella, syphilis, tetanus, VHF, WNV, yellow fever. 3. • Confirmed: classification of cases is based on laboratory confirmation. All diseases should be reported as confirmed after completion of diagnosis.	
Data sources and data flow	1. Sources: 2. Laboratory 3. Primary Healthcare 4. Hospital 5. Specific health program 6. Data flow: 7. Known data provider 8. Awareness for clinical diagnosis, case confirmation, and gathering of additional information 9. Identified data recipients: public health institutions that provide feedback information to participants of the case reporting process, public health professionals, and the general public	

Surveillance networks	1. Local network: MOH with other health institutions 2. Regional network: group of countries 3. International network: WHO and other organizations	
Population under surveillance	General population Targeted groups: at-risk groups	
Geographic coverage	1. Regional 2. National	
Type of surveillance	1. Passive: relies on the physicians, laboratory or hospital staff or other relevant sources to take the initiative to report data to the health department 2. Active: based on the public health officials› initiative to contact the physicians, laboratory or hospital staff or other relevant sources to report data 3. Sentinel: relies on notifications from a selected group of physicians, hospitals, laboratories, and other institutions.	

Specification of the information to be reported	1. Case-based: information on individual records related to a disease/health event 2. Aggregated reporting: information related to a group of people classified under the same category for a disease or health-related event 3. Specification of variables: variables and related coding systems for a disease/health-related event are specified for all case-reporting disease and based on surveillance objectives. 4. Frequency of data collection & reporting are identified: daily, weekly, monthly, quarterly, annually	
Reporting format	1. Paper-based system 2. Electronic	
Data entry	1. Web-based: HESN 2. Interface mediated: Excel, 3. Open-source software: free online application (Epi Info)	
Database architecture	• Centralised: one main server in MOH headquarters • Distributed: number of servers in regions	

Items describe the element of the surveillance system can be measured by percentages.

* Applicability of an element equals the average of total percentages selected by the respondents.

Table 2. Calculation of sensitivity* and predictive value positive+ for a surveillance system.

Detected by surveillance	Condition present		
	Yes	**No**	
Yes	True positive A	False positive B	A+B
No	False negative C	True negative D	C+D
	A+C	B+D	Total

* Sensitivity = A / (A+C)
+ Predictive value positive (PVP) = A / (A+B)

Table 3. Characteristics of disease/health event surveillance (Summary).

Attribute	Indicator	Scale (%)
Completeness	• Completeness of data reported: percentage of cases recorded in a database with no missing required information (by disease, region, surveillance unit) • Percentage of missing information by required field (disease specific)	
Validity	• Proportion of cases complying with case definition • Proportion of coding errors within a dataset • Proportion of values that comply with a gold standard or reference value (to be defined for specific diseases)	
Sensitivity, positive predictive value	• Sensitivity of outbreak detection: number of outbreaks detected divided by the number of occurring outbreaks. • If comparison with an external source: proportion of values that were not captured by the ‹official› notification system	

Timeliness and reactivity	• Proportion of surveillance units that submitted surveillance reports (weekly, monthly, annually) according to a predefined schedule • Proportion of outbreak notified within ٤٨ hours of detection • Proportion of suspected outbreaks that were verified within ٤٨ hours of notification • Average time interval between date of onset and date of notification by general practitioners/hospital (by disease, region, surveillance unit) • Average time interval between date of outbreak notification and date of first investigation (by disease, region, surveillance unit)	
Representativeness	Population covered by the surveillance system (based on surveillance objectives), divided by the total population for a defined geographic area	
Usefulness	Rating of the usefulness of the surveillance system. Indicators of usefulness can be described as actions taken as a result of surveillance outputs	

Simplicity	• Amount and type of data necessary to establish that the health-related event occurred (a case of communicable disease, an outbreak) • Amount and type of other additional data collected on cases • Number of organisations involved in receiving case reports and outbreak reports from a surveillance unit • Amount of follow-up that is necessary to update data on the case • Method of managing the data, including time spent on transferring, entering, editing, storing, and backing up data • Time spent on system maintenance	
Flexibility	• Ability to add new disease / health event to the system. • Ability to adapt with changes in the structure of the system at all levels. • Ability to operate the system electrically or manually. • Ability to use different electronic applications. • Ability to exchange data among electronic applications of the system. • Changes to the system do not require additional budget or manpower.	
Acceptability	• Subject or agency participation rate and time required to report the cases. • Data completion rate. • Interview completion rates and question refusal rates (if the system involves interviews)	

Extent of indicator application depends on the type of disease under surveillance. For some diseases, it is difficult to
diagnose and confirmation process takes long time. In this case, application of surveillance characteristics is not
expected to be high.

* Suggested scale of collecting data for each indicator: 0=Not Applicable, ,%20=1 %100=5 ,%80=4 ,%60=3 ,%40=2.

Reference values:

- Weak: less than %50,
- Satisfactory: %60 - 50,
- Good: %70 - 61,
- Very good: %80 - 71,
- Excellent: more than %80

Table 4. Notifiable diseases in Saudi Arabia

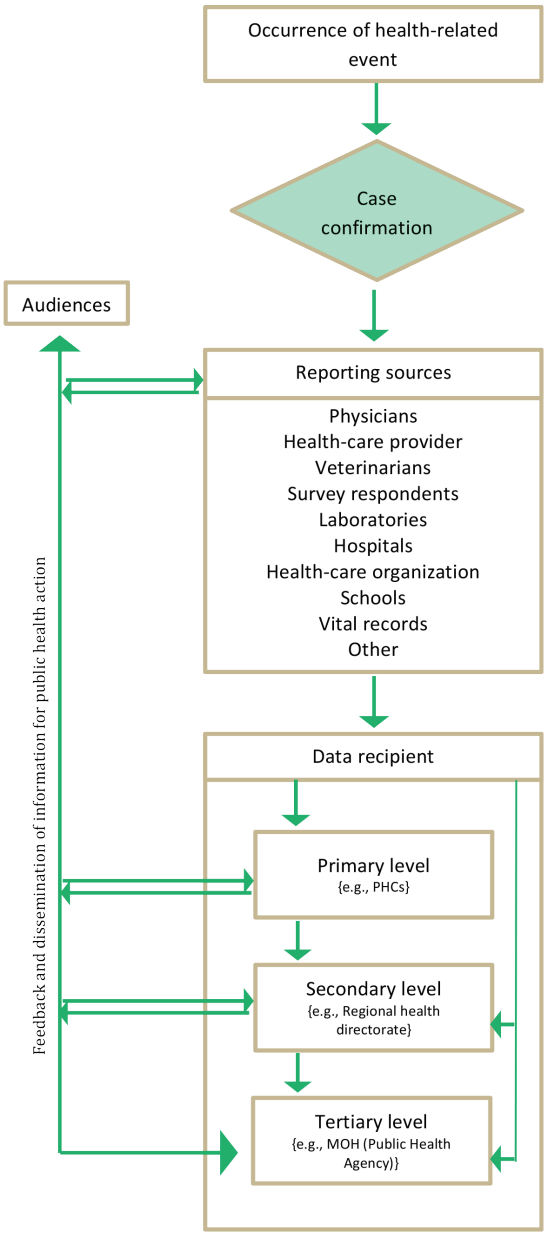
Section I: Infectious Diseases That Should Be Notified Immediately (within 24 H) By Fax or Phone

1. Cholera 2. Plague 3. Yellow Fever 4. Neonatal Tetanus 5. Diphtheria 6. Measles 7. Rubella 8. Congenital rubella 9. Mumps 10. Pertussis	11. Acute Flaccid Paralysis - Suspected Poliomyelitis - Guillian Baree - Transverse Myelitis - Other suspected Polio cases	For ages < 10 years	12. Meningococcal Meningitis 13. Haemorrhagic fevers: • - Dengue fever • - Rift valley fever • - Lassa • - Ebola • - Crimean-Congo • - alkhomra • - Other haemorrhagic fevers 14. West Nile Virus Fever	15. SARS 16. Rabies 17. Ántrax 18. Avian Flu 19. MERS CoV. 20. HINI critical cases. 21. Any emerging disease 22. Any disease that appears in epidemic even if it is not included in section I & II. 23. Q fever

Section II: Infectious Diseases That Should Be Notified Weekly to the Region and Then Monthly to the MOH

24. Chicken pox 25. Tetanus other 26. types 27. Viral hepatitis - Hepatitis A - Hepatitis B - Hepatitis C - Hepatitis D - Hepatitis E Unspecified Hepatitis (other types	28. Typhoid and paratyphoid 29. Brucellosis 30. Amoebiasis 31. Salmonellosis 32. Shigellosis	33. Pneumoccal meningitis 34. Haemophalus meningitis 35. Other meningitis 36. Hemolytic uremic síndrome 37. Echinococcosis 38. HINI	39. Tuberculosis. 40. leprosy. 41. HIV. 42. STI 43. STI síndromes. 44. Malaria 45. Leishmania. 46. schitosomiasis

Figure 1. Simplified flow chart for a generic surveillance system.



An infectious, chronic, or zoonotic diseases; injury; adverse exposure; risk factor or protective behavior; or other surveilled event associated with public health

Identification by whom and how

Reporting process
** Data entry and editing possible*
** Assurance of confidentiality*

Data management
** Collection*
** Entry*
** Editing*
** Storage*
** Analysis*
** Report generation*
** Report Dissemination*
** Assurance of confidentiality*

SDMU
Surveillance and Data Mangement Unit

Figure 2. Simplified example of steps in a surveillance system.