

Public Health Surveillance- A Tool for Exploring the Interventions for Global Health Protection

^[1]Dr Yashoda Tammineni, ^[2]Teja Dakuri

^[1]HOD, Department of HSE, National Institute of Fire Engineering and Safety Management, Visakhapatnam

^[2]Pursuing INDUSTRIAL SAFETY.DIBBAPALEM, PEDAGANTYADA, VISAKHAPATNAM, ANDHRA PRADESH

Abstract: - Recently, global health and public health surveillance have received unprecedented recognition for their importance in dealing with the newly emerging and recurring infectious diseases, new cycles of pandemics, and the threats of biological hazards. Currently, the world is experiencing the most treacherous and hazardous situation with a vulnerable crisis situation created by a daredevil named 2019 Novel Corona virus. In this context, it is proposed to provide an update of the current state of knowledge on health surveillance in a globalized scale and the present scenario suggests that there should be a greater emphasis on public health surveillance systems that can provide information to guide public health decisions in many areas including disease prevention, prevention program planning, management and health promotion especially at workplaces.

Key words— Public Health Surveillance, Pandemics, Medical Surveillance, Public Health Interventions.

I. INTRODUCTION

Global outbreaks, including those of severe acute respiratory syndrome (SARS), Ebola virus disease and COVID-19 reminds us that a public health event in a single location can rapidly become a global crisis. Control of infectious diseases can therefore be considered a global public good, and public health surveillance is a tool that helps achieve it. Timely sharing of public health surveillance data enables better preparedness and response, locally and globally. Public health surveillance is a tool to estimate the health status and behavior of the populations served by ministries of health, ministries of finance, and donors. Because surveillance can directly measure what is going on in the population, it is useful both for measuring the need for interventions and for directly measuring the effects of interventions. The purpose of surveillance is to empower decision makers to lead and manage more effectively by providing timely, useful evidence.

II. ROLE OF WHO IN SURVEILLANCE

During a pandemic, WHO intends to focus on different surveillance components. It shall collect information regarding events through its surveillance activities. WHO recommends the inclusion of a pandemic surveillance in any updated pandemic preparedness and response plan. Ideally, the surveillance annex would be based on this guidance and would outline the surveillance approach to be used during pandemics, including:

- resources and funding,
- including how existing surveillance systems would be used during a pandemic;
- data and information requirements for the different phases of the pandemic;
- data sharing, reporting and communications;
- risk assessment questions;
- triggers for surveillance escalation and de-escalation;
- evaluation; and
- linkages between surveillance, risk assessment and response.

WHO will report the surveillance data provided. These reports include alerts, situational summaries, tables, charts and maps of the evolving pandemic situation. It will use the information provided to inform global risk assessments, including mathematical modelling of the epidemic, to better understand the spread of the pandemic and the effectiveness of mitigation measures.

III. BIOMEDICAL SURVEILLANCE

Medical surveillance consists of systematically and periodically collecting and analyzing health data on groups of employees to monitor changes in health status over time. Medical surveillance is the analysis of health information to look for problems that may be occurring in the workplace that require targeted prevention. Thus, surveillance serves as a feedback loop to the employer. Medical surveillance helps to achieve primary, secondary, and tertiary prevention of workplace diseases and injuries.

- Primary prevention refers to the prevention of illness or injury. The aim of primary prevention is to reduce or eliminate risk by preventing or mitigating exposures.

- Secondary prevention refers to early detection and intervention to halt or reverse the progression of disease, before long-term health consequences occur. Medical surveillance data helps occupational health and safety personnel focus on effective disease and injury countermeasures.

- Tertiary prevention refers to medical interventions that alter the course of the disease and reduce the severity or recovery time, allowing employees to return to work earlier than otherwise would be possible. Medical surveillance may guide inquiries regarding which occupations involve risk and the degree of impairment resulting from each type of injury or illness.

Medical surveillance is prospective and should be effective, efficient, and economical in terms of program design, medical screening performed, and use of the surveillance data. Medical surveillance is different from medical screening. Medical screening is a method for detecting disease or body dysfunction before an individual would normally seek medical care. Screening tests are usually administered to individuals without current symptoms, but who may be at high risk for certain adverse health outcomes. Primary prevention, screening, and directed exposure countermeasures constitute effective medical surveillance.

Before initiating a medical surveillance program, an occupational health program manager should identify the reasons for conducting medical surveillance and define which health indices should be monitored. Most civilian workers today perform administrative tasks with minimal physical job demands or potential for exposure to job-related hazards. This group of workers is best targeted for health promotion and wellness initiatives and periodic health history screening to ensure that chronic disease risk is being managed appropriately.

The second group of employees has physical requirements specified in their job description that require sufficient health and fitness to perform their work safely and effectively. Medical screening in this group focuses on ensuring the employee can meet the physical requirements of the position while performing the essential job functions without undue risk to themselves or others.

Job-related medical surveillance must be tailored to employees based on job titles, worksites, or documented exposures and individual susceptibility to chemical, physical,

or biological agents that may be hazardous. This is particularly true when exposures exceed standards in order to detect early health effects, monitor the effectiveness of the controls, and monitor the extent of the exposure.

A medical surveillance program is based on industrial hygiene sampling data, which helps the occupational health provider decide who is exposed in the workplace and when the exposure exceeds thresholds that mandate medical surveillance. The determination of who to enroll in the medical surveillance program is often challenging because industrial hygiene sampling data is often not available, and instead healthcare providers must rely on the employee to provide a good occupational history (which may include self-reported exposures). When industrial hygiene sampling data is lacking, sampling done in similar exposure groups may provide clues as to whether exposure in the local workplace may be occurring.



Figure 1: Process of Biomedical Surveillance.

Workplace exposures may trigger concern by employees, regardless of the level of exposure or potential for adverse health outcome. However, when employees face uncontrolled exposures in the workplace, steps must be taken to alleviate their concern and countermeasures implemented to eliminate the exposure. Once an exposure meets or exceeds the threshold for enrollment in medical surveillance, the employee should be examined for potential health effects. Knowledge of how toxic substances affect organ systems is critical to designing the medical surveillance program to look for internal dose, measures of early biologic effects, and end organ damage. When the pathway from external exposure to internal exposure is completed, the severity of the effect is determined by the route of entry, level and duration of exposure, and how the substance is metabolized in the body. Knowledge of the full range of possible health effects is important to identify adverse health effects in exposed workers.

The content of the surveillance examination must be determined once the need for medical surveillance has been established. There are four parts of the medical surveillance examination:

1. Medical and employment history;
2. Physical examination;

3. Diagnostic testing, including laboratory tests and radiological exams; and
4. Special studies that include electrocardiograms (EKGs), PFTs, treadmill stress tests, and biological monitoring.



Figure 2: Maintaining Medical Record in Workplace.

The medical surveillance program must be managed, and the data collected must be used appropriately. The healthcare provider must inform the employee of the screening results and recommend appropriate medical follow-up, including a determination of whether the exposure was work related. If the abnormal screening tests indicate an unacceptably high exposure has occurred, then the employee should be considered for temporary duty restrictions with a goal of reducing or eliminating workplace exposure through temporary job reassignment or time off.

Designing an effective surveillance program has to be tailored to the workers, their exposures, and the biological effects of exposures. Medical surveillance also establishes the work ability of service members and civilian employees to assure that personnel can perform their job safely. Those employees who work with potentially hazardous chemical, physical, or biological agents require medical surveillance only when workplace exposures exceed safe levels specified by OSHA, the ACGIH. The surveillance is designed to detect service member and civilian exposures that produce exposure-related health effects and to monitor the effectiveness of workplace controls. Job-related medical surveillance in occupational and environmental medicine consists of systematically and periodically collecting and analyzing health data on groups of service members and civilian employees for the purpose of early detection of personnel who are at increased risk of developing disease or identifying those who have developed workplace-related diseases and injuries.

While biomedical surveillance is good enough to gather and study about workplace hazards, similar data collection and assessment is necessary for the study of disease rate in any country. Even in the workplace, most of the informal workers and migrant labor are not allowed to participate in

these screening process. And in countries like India where the labor in unorganized sector account up to 82% of total workforce the study of the biomedical surveillance is limited. So, the solution for this is the public health surveillance.

IV. PUBLIC HEALTH SURVEILLANCE

Public health surveillance is considered to be an essential public health function. A public health system is said to have five essential functions: population health assessment, health surveillance, health promotion, disease and injury prevention, and health protection. Public health surveillance is considered the best weapon to avert epidemics.

According to the World Health Organization (WHO), Public health Surveillance is, "the continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice." Health surveillance is a public health methodology, which aims to detect undesired health effects in a given population; with the primary aim to eliminate the source of the problem. Public health surveillance may be used to track emerging health related issues at an early stage and find active solutions in a timely manner. Surveillance systems are generally called upon to provide information regarding when and where health problems are occurring and who is affected.

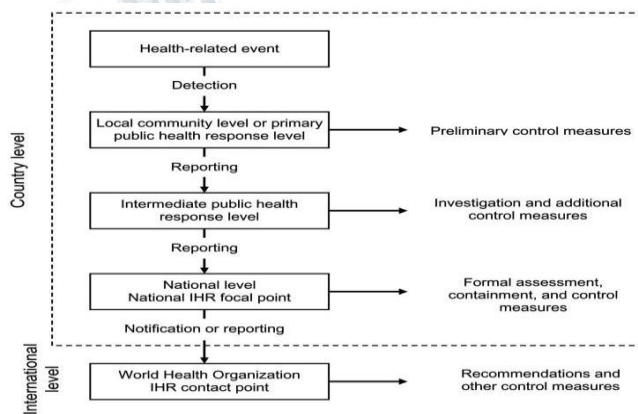


Figure 3: Public health surveillance structures and processes specified in International Health Regulations (IHR) 2005.

4.1. Passive Surveillance and Active Surveillance.

Public Health surveillance systems can be passive or active. Passive surveillance systems refer to routine notifiable-disease reporting. This is simple and not burdensome to the health department but is limited by incompleteness in reporting. Also, because passive surveillance depends on people in different institutions to

provide data, data quality and timeliness are difficult to control.

To overcome limitations of passive systems, active surveillance systems involve regular outreach to potential reporters to stimulate the reporting of specific diseases. This can be used to validate the representativeness and completeness of passive reporting. As active surveillance employs staff members to regularly contact health care providers or the population to seek information about health conditions, it provides the most accurate and timely information, but it is also expensive.

4.2. Usefulness of Public Health Surveillance

The World Bank described six categories of uses of public health surveillance.

1. Recognize cases or clusters of cases to trigger interventions to prevent transmission or reduce morbidity and mortality.

2. Assess the public health impact of health events or determine and measure trends.

3. Demonstrate the need for public health intervention programs and resources, and allocate resources during public health planning.

4. Monitor effectiveness of prevention and control measures and intervention strategies.

5. Identify high-risk population groups or geographic areas to target interventions and guide analytic studies.

6. Develop hypotheses that lead to analytic studies about risk factors for disease causation, propagation, or progression.

4.3. Categories (adapted from the World Bank) and examples of uses

(1) Early warning: serves as an early warning system to identify new emerging health problems

a. Recognize cases or clusters of cases to trigger interventions to prevent transmission or reduce morbidity and mortality.

b. Serve as an early warning system to identify public health emergencies.

c. Detect epidemics.

(2) Impact assessment: assesses public health impacts and trends of new emerging health problems

a. Assess the public health impact of health events or determine and measure trends.

b. Estimate magnitude of a health problem.

c. Document the distribution and spread of a health event.

d. Portray the natural history of a disease.

e. Understand the economic and health impacts of a public health issue, and the nature and extent to which it disrupts communities.

(3) Intervention development and implementation: develops public health interventions and strategies and allocates public health resources

a. Demonstrate the need for public health intervention programs and resources, and allocate resources during public health planning.

b. Lead to immediate public health action.

c. Set priorities and guide public health policy and strategies.

d. Rapidly communicate information among public health officials and health care workers so they can take appropriate actions to resolve problems.

e. Appropriate and allocate prevention and care resources.

f. Make informed decisions related to resource allocation.

(4) Intervention evaluation: evaluates public health interventions and strategies

a. Monitor effectiveness of prevention and control measures and intervention strategies.

b. Evaluate control and prevention measures.

c. Evaluate programs, policies, and control measures.

d. Monitor isolation activities.

e. Detect changes in health practice.

f. Document impact of an intervention or progress towards specified public health targets/goals.

(5) Risk assessment: identifies risk factors and high-risk populations

a. Identify high-risk population groups or geographic areas to target interventions and guide analytic studies.

b. Monitor changes in infectious agents.

c. Understand the factors that cause health events, both at the individual and community level.

d. Monitor and clarify the epidemiology of health problems.

e. Reduce the risk of the occurrence of public health crises.

(6) Research: supports public health research

a. Develop hypotheses that lead to analytic studies about risk factors for disease causation, propagation, or progression.

b. Formulating research hypotheses.

c. Generate and test hypotheses.

d. Identify priorities and hypotheses for research.

e. Facilitate epidemiologic and laboratory research.

Techniques of public health surveillance have been used in particular to study infectious diseases. Many large institutions, such as the WHO and the CDC, have created

databases and modern computer systems (public health informatics) that can track and monitor emerging outbreaks of illnesses such as influenza, SARS, HIV. Many regions and countries have their own cancer registry, one function of which is to monitor the incidence of cancers to determine the prevalence and possible causes of these illnesses. Other illnesses such as one-time events like stroke and chronic conditions such as diabetes, as well as social problems such as domestic violence, are increasingly being integrated into epidemiologic databases called disease registries that are being used in the cost-benefit analysis in determining governmental funding for research and prevention.

Syndromic surveillance is the analysis of medical data to detect or anticipate disease outbreaks. According to a CDC definition, “the term 'syndromic surveillance' applies to surveillance using health-related data that precede diagnosis and signal a sufficient probability of a case or an outbreak to warrant further public health response.” Using a normal influenza outbreak as an example, once the outbreak begins to affect the population, some people may call in sick for work/school, others may visit their drug store and purchase medicine over the counter, others will visit their doctor's office and other's may have symptoms severe enough that they call the emergency telephone number or go to an emergency department. Syndromic surveillance systems monitor data from school absenteeism logs, emergency call systems, hospitals' over-the-counter drug sale records, Internet searches, and other data sources to detect unusual patterns. When a spike in activity is seen in any of the monitored systems disease epidemiologists and public health professionals are alerted that there may be an issue.

Public health surveillance relies on public health information systems that have been defined to include a variety of data sources essential to public health action. Computer technology can improve these public health information systems which vary from a simple system collecting data from a single source, to electronic systems that receive data from many sources in multiple formats, to complex surveys. As the number and variety of systems will likely increase, future efforts of public health surveillance should focus on advances in electronic data interchange and integration of data, which will also heighten the importance of patient privacy, data confidentiality, and system security.

The use of the latest technology and informatics system must be implemented in possible phases to simplify the data collection process. These measures are necessary to safeguard ourselves from increasing disease rates and types and to put a check on it while identifying its counter measures.

So, with the active implementation of public health surveillance we can have the records and information of the

disease rate and spread which helps to focus the government funding for elimination of disease that cause a lot of public concern or to take necessary action in particular regions where a certain disease is more prone to create a serious impact. This also gives the emerging disease information which can be shared to WHO, CDC and other institutes to alert them and to import measures that are effective and already being implemented by some nations.

5. Conclusion.

Global outbreaks, including those of severe acute respiratory syndrome (SARS), Ebola virus disease and the recent novel COVID-19 reminds us that a public health event in a single location can rapidly become a global crisis. Control of infectious diseases can therefore be considered a global public good, and public health surveillance is a tool that helps achieve it. Timely sharing of public health surveillance data enables better preparedness and response, locally and globally. From a societal perspective, public health surveillance systems increase the efficiency and effectiveness of the public health system, which is a primary determinant of population health.

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