Health AffairsISSN - 0278-2715 Volume 11 CURRENT ISSUE page 1584-1599
Journal link: https://health-affairs.org/
Abstract Link: https://health-affairs.org/

# The Role of Public Health Surveillance Systems in Early Detection and Prevention of Chronic Diseases

**[1]Dr Muneer akhtar Alias Waseem, [2]Mansoor Ali, [3]Dr. Marium Khalil, [4]Taimoor Ghori, [5]Khurram Ali, [6]Marwa Riaz**

**Submission**: 31 January 2026 | **Acceptance**: 25 February 2026 | **Publication**: 03 April 2026

[1]Assistant DHO EPI and Polio District Tharparkar
[2]UHS Lahore
[3]Institute of Public Health Lahore
[4]PIMS Islamabad
[5]PIMS Islamabad
[6]UHS Lahore

**-Abstract**

**Background:** Noncommunicable diseases including cardiovascular diseases and health, diabetes, and cancer continue to be a major public health concern internationally. Screening and control of such disorders are crucial in minimizing morbidity, mortality and health care costs. Population surveillance forms part of PHBLs and assists in disease detection, risk groups identification and subsequent intervention measures.

**Aim:** As such, this paper seeks to understand the place of public health surveillance systems in PR diagnosis and protection of chronic ailments. It will also look at the way these systems work; how successful they are in detecting new health threats; and management strategies used to stop chronic diseases in populations.

**Methods:** A review of past literature was done to establish the current knowledge on public health surveillance systems with emphasis on acute chronic diseases. To evaluate respective outcomes and the efficiency and effectiveness of Surveillance systems in different parts of the world, twenty four articles were chosen, of which involved the use of six peer-reviewed articles with focus on implementation, success rates and challenges in surveillance systems, six case studies and twelve government reports.

**Results:** According to the mass public health surveillance systems including the BRFSS and NHANES; have shown much success in early disease identification and prevention. These offer important information for the planning of public health, aim on vulnerable populations, and help with decision making on resource utilization. Though, with obstacles like under-representation, poor data quality, reduced availability of near real-time information, they remain constrained.

**Conclusion:** Essentials in early detection of chronic diseases and other conditions associated with ill health, are surveillance systems for public health. It is, therefore, possible to reduce the burden of chronic diseases by improving the implementation process, data collection and use of timely interventions. However, increasing the improvement of the SS, filling the gaps, and incorporating technology into the system also provide excellent opportunities to improve the impact of surveillance systems on public health.

Health AffairsISSN - 0278-2715 Volume 11 CURRENT ISSUE page 1584-1599
Journal link: https://health-affairs.org/
Abstract Link: https://health-affairs.org/

**Keywords**: Public health surveillance, chronic disease prevention, early detection, healthcare policy, disease monitoring, public health systems, behavioral risk factors.

## Introduction

Surveillance is an important component of the overall Endeavor in public health, whereby health care programs in the community seek to track the health status of the populace. The systematic assessment, analysis, interpretation and dissemination of health related data for planning, implementation, and evaluation of health on the population. The main function of the disease surveillance systems is to identify new threatening diseases, observe the disease trends, and assess the efficiency of a disease control and prevention program. Surveillance is a fundamental technique in epidemiological research and crucial for early identification of disease, especially chronic disease, that remains a major health threat worldwide [1].

Public health surveillance is therefore a systematic approach of tracking, gathering and analysing information on certain health events or diseases in a population. Depending crucially on the methods of data collection and purpose of the data these systems can be classified into some types. The basic categories are passive, active and Sentinel surveillance.

Passive Surveillance is probably the most conventional, where statistics on health are acquired from clinics and laboratories. Hearing-type surveillance usually means-that the information is collected less frequently and with fewer resources, and may include reports from the healthcare facilities, which can not always be complete or up to date [2].

From the foregoing it is clear that active Surveillance is a more aggressive, structured process in which public health workers go out in the field to collect data that is usually obtained through surveys, case finding and follow-back of healthcare facilities and patients. This type of surveillance is more costly than passive but is usually accurate and up to date than passive surveillance.

Sentinel Surveillance is generally applied when total compulsory reporting of cases is not possible for a community. In this system, certain locations or groups (sentinels) are selected to detect certain health conditions, serving a useful purpose to estimate trends in selected areas or among certain demographic categories [3].

Syndromic Surveillance is relatively new and involves timely observation of some symptoms and clinical information that is particularly useful in contagious diseases or outbreak investigation.

All types of surveillance systems have a specific role though collectively play an important role in disease diagnosis, distribution and changes with time. In the context of chronic diseases, the aforesaid systems assist in establishing increasing trends of disease prevalence and facilitate early intervention to mitigate effects to those most affected populations.

Often referred to as non-communicable diseases, a number of chronic conditions including heart illness, diabetes, chronic respiratory diseases and cancers are major causes of mortality and morbidity all over the globe. It reported from the WHO that chronic diseases contribute to 70 percent of the global mortality while cardiovascular diseases alone are estimated to cost about 17 million deaths per year. Aging populations, improper diet, physical inactivity stress, smoking and various environmental factors all have led to the increase in prevalence of chronic diseases. Such diseases normally progress slowly and may not show any symptoms until the disease is well advanced, early diagnosis is therefore important.

Early detection is pertinent because it may triumphantly change the course of chronic illnesses.

Chronic conditions also are easier to treat if diagnosed earlier, and their advancement can be halted or even reversed if treated by proper changes in diet, medications and surgery. For instance, we are able to identify early signs of hypertension (high blood pressure) so that the people are able to change their diet, physical activity, and take medicine to prevent development of heart diseases or stroke. Likewise, early detection of the disease lets the patient monitor blood sugar levels; this helps to avoid development of such conditions as renal failure, nerve damage, and loss of vision [4].

The problem here relates to the fact that most chronic diseases do not show symptoms when they first develop. This is why surveillance systems are important since they may not realize that they are sick until the disease has really taken its toll. Surveillance assists in the early detection of candidates most likely to develop chronic diseases before onset of symptoms and therefore intervention can be done. Some of the illnesses such as Cancer, if diagnosed early enough, this can be a big boost on the patients' chances of survival. For example, breast cancer and colon cancer screenings are effective at decreasing mortality due to cancer because they find the disease at the right time when the treatment is most proficient.

Apart from the self-essence of its contribution to health, diagnosis of chronic diseases at an early stage has broad-scope impacts on a society. As such, there is a need to know the status of chronic diseases so as to decide on what is likely to happen in future, produce health policies, budget for necessary resources, and launch disease control measures. These programs especially target people with pre-condition factors, which include family history of some diseases, obesity, or people with low levels of physical activity. What is more, it is focused not only on individual diseases but on social burden of chronic illnesses, such as expenses for treatment, decreased performance, and quality of life.

The link between the tracking systems of public health and the health of chronic illnesses is immensely strong. While surveillance systems are used in today's society to determine who may require more attention in terms of healthcare as well as to help track the spread of diseases thus also to assess the efficiency of recommended measures. Continuous data gathering makes surveillance systems effective in identifying trends or new risks or changes in diseases' trends at the population level [5].

The distinctive tasks include the identification of groups most at risk. Through the assessment of factors including age gender, socioeconomic status dieting and physical activity, the public health surveillance system can easily pinpoint suspected populations with high risks of developing chronic diseases. For example, analysis of surveillance data might show that people of some race or ethnic origin are at higher risk of developing diabetes because of genetic factors, or people living in low income neighbourhoods are likely to be obese because of absence of access to healthy food. Such information enables public health workers to create specific prevention programs for these populations including health promotion campaigns, free screening and/or treatment, or public policy solutions in terms of availability of healthful foods and physical activity opportunities.

Surveillance systems also aid in tracking patterns within populations concerning behaviours that increase risk factors for chronic diseases including smoking, obesity and lack of regular physical activity. When these behaviours are followed systematically such data can be used to evaluate the success of public health campaigns/policies that are meant to address these risk factors. For instance, smoking bans in the public places, tobacco taxes or anti smoking education programs can be assessed with smoking prevalence data garnered from the surveillance systems. Similarly, effects of national/ regional promoting physical activity or healthy eating can be monitored based on the obesity rates/ or diet related health indicators derived from surveillance data.

In addition, surveillance systems give useful data on specialised programmes for early detection. For instance, screening programs for high-risk population (mammography for women aged 50 and more, colonoscopy for individuals aged 50 and more) may be compared on incidence and mortality rates before and after the screening program has been initiated. These assessments are useful in presenting recommendations and adjustments to enhanced uses of preventive measures for resources.

All in all, it has been noted that public health surveillance systems are important in initiating the screening processes and control of chronic diseases. These systems offer information that can be used to early detection of increasing incidence of diseases, establish potential threats, and evaluate potential protective measures. Surveillance together with early identification is a critical component that enhancing the health status of people, containing the costs of healthcare and overall evaluating quality of life among population. Given the increasing trend of chronic diseases in the world ensuring robust and broad health monitoring systems will be crucial in mitigating the effects of chronic diseases in society [6].

## Materials and Methods

Bio surveillance systems use different types of data capture and analysis to follow the incidence of diseases, such as chronic diseases, in populations. These systems are intended to collect data, assess it and make interpretations that will help in making appropriate intervention actions. The kind of surveillance system is also important together with the methods that are used in collecting data and the ways in which data collected is analysed in order to determine the part that surveillance plays in early diagnosis of chronic diseases.

Passive Surveillance is by far the most common type of surveillance: it operates on the basis of the information submitted voluntarily to health care providers, laboratories and other institutions that are legally mandated to report particular conditions. This system is quite generic and not very expensive, as it utilises the already existent reporting hierarchy paradigm within healthcare organisations. However, since the system relies on the healthcare practitioners to report cases on their own accord, it is prone to infections such as under-reporting, delay in reporting and incomplete information. However, passive surveillance has some drawbacks, yet it can still be used with success to monitor broad trends and specific, periodically changing, disease patterns. It is probably helpful in identifying persistently progressing chronic ailments that do not necessarily require healthcare givers to report, like diabetes and hypertension.

On the other hand, Active Surveillance, refer to a situation where public health authorities go out and source data using direct approaches such as by contacting health care facilities or the public. This method is costlier than passive surveillance but the results are often more accurate and of higher reliability than passive surveillance. Survey of facility or household research of public health by healthcare facilities, follow-up assessment of patient records could also involve routine examinations with the concerned healthcare facility or directly with the patient. It is helpful in researching novel trends or situations for which there is a belief that passive reporting can be inconclusive in identifying disease or health condition occurrences. In chronic disease management, active surveillance enables one to get closer looks into condition like heart diseases or cancer that require early detection and intercession [7].

Sentinel Surveillance can be said to be the tracking of particular, chosen sites or people on the basis of their presumed likeness to the general population. It is however different from collecting information from the population as a whole, it only collects more detailed information from a specific group or

groups referred to as 'sentinels', for instance specific hospitals, clinics or sub populations. This has been especially advantageous where resources are scarce as this kind of surveillance is normally done in areas/in populations that will hopefully provide a good picture of the trends in health events. In other instances, sentinel surveillance could be applied to monitor the occurrence of chronic diseases in certain districts or demography, these results would guide the intervention. Sentinel surveillance systems are valuable in diseases whose incidence patterns are community dependent for diseases like obesity that may afford some client groups more than others.

Syndromic Surveillance is relatively newer form of Surveillance, and it targets the identification of disease outbreaks or the emergence of diseases from their symptomology rather than their classical definitions. This system frequently relies on data flowing from health delivery zones including emergency departments, pharmacies and clinics to document distinct symptoms suggesting the beginning of a chronic disease or an outbreak of the disease. One reason that make syndromic surveillance effective for early detection is that it is possible to spot a new possible threat to the health of the public before achieving a standard diagnosis. For chronic diseases, the system can used to monitor trends or epidemic of related symptoms for example chest pain, difficulty in breathing or abnormal weight gain that may be associated with heart disease or respiratory disorders, diabetes respectively.

Basically, the efficiency of public health surveillance depends on data collection techniques most of the time. Different approaches can be used: cross-sectional, cohort, case-control and specialist hospital case notes, national register.

Health Surveys are one of the best methods of getting information on Health Behaviours, Diseases and Risk Factors among populations. Polls are normally employed routinely by the leading national health organizations or research institutions with the coverage of a sample of the population. Some surveys can include data in diet, habitual movements, tobacco and alcohol consumption, existing chronic diseases. On example of a large-scale health survey is the Behavioral Risk Factor Surveillance System (BRFSS) USA which uses telephone interview includes all adults to assess risk behaviours, chronic conditions and preventive health practices.

Another primary source of information for surveillance of chronic diseases is Hospital Records. Electronic health records from various health care institutions include details of patient diagnosis, treatment and prognosis that are useful in assessing the prevalence and characteristics of a disease. These records may be scanned and then kept in an electronic health record or EHR that has the benefit of making it easier to obtain data on groups of patients. Sometimes, passive systems are facilitated by mandatory reporting of specified diseases by hospitals to the public health departments. Charts can also be used for further analysis in active surveillance systems, in which researchers or health officers may search records for certain information on chronic diseases [8].

National Registries are collection processing centre's which are involved in disease surveillance of particular diseases or health conditions prospectively. Such registries can present an effective picture of chronic diseases' occurrence and dynamics, including cancer, diabetes, or cardiovascular diseases, over a long time. National registries are widely set up by government organizations or other research institutions and can contain clinical as well as epidemiological data. For example, there are cancer registries which include cancer incidence surveillance systems and treat survival and outcomes of treatment across population including the NCDB in United States.

The other factor that influences the efficiency of surveillance system is on the type and way in which the data collected from the surveillance system is analysed. Most of the data are analysed through

statistical approaches, modelling approaches, and trends.

Descriptive analytics is employed to analyse data and to distinguish characteristics of the distribution and occurrence of diseases. Results are divided into descriptive statistics where mean, median and standard deviation are used hence inferring statistics like the regression analysis uses on relations hitches between risk factors and chronic disease outcome. With the help of these statistical tools researchers and officials in public health can decide whether there is a tendency in the rates of chronic diseases among certain populations or at certain time periods.

Advanced analytics methods like data mining, machine learning and artificial intelligence have pointed out a new direction in Disease Surveillance System. Using, for instance, predictors derived from the statistics, these models can predict future incidences of a disease,/risk ratio or even probability of occurrence. These models can especially be of great use in chronic disease control as the officials can plan intervention in light of the risks as predicted.

Trend Analysis refers to the study of fluctuations of disease patterns in a given area at varying intervals. To be specific, the long-term trends in the rates of chronic diseases, their incidence and prevalence are valuable for the state-level public health planning because they allow to foresee potential future problems and invest correspondingly. This kind of analysis is crucial when evaluating the successes and the failures of an early detection and prevention system to establish which of these areas should attract more focus [9].

Many nations have successfully put into place public health surveillance systems for tracking chronic diseases for the aim of fostering early identification and fruitful prevention. For instance, Finland embraced wide ways in surveillance in chronic diseases especially cardiovascular diseases and diabetes. FINRISK, the National Cardiovascular Risk Factor Survey of Finland, gathers information on a broad spectrum of risk indicators, including smoking, exercise regimen and dietary habits, to estimate the future cardiovascular burden of disease. On the basis of above surveillance data, the effective public health interventional strategies have been designed and implemented in form of smoking cessation, diet improvement and promoting active lifestyle.

Likewise, in United States of America a number of surveillance systems have been employed for chronic diseases such as National Health and Nutrition Examination Survey (NHANES) and Behavioral Risk Factor Surveillance (BRFSS). Such systems assemble information on virtually every conceivable type of illness and disease risk factor and serve to shape both national health policies as well as local level health programs. For instance, data gathered from the various systems have help in the identification of risky groups concerning s diabetes and cardiovascular illness, and subsequent use of Health education and screening programs.

In Australia, data concerning population with diabetes and its management are reported by both healthcare facilities and users with diabetes through National Diabetes Services Scheme. It has also assisted in monitoring the impact of interventions, and evaluate the efficacy of diabetes management programs, that are instrumental in containing the increase rate of diabetes among the population.

The above-discussed successes illustrate that if integrated surveillance system in public health is well designed, it can play a key role in early identification and control of chronic diseases. Surveillance systems enable an understanding of the chronic diseases more info on their incidence and risk factors that ought to help in implementation of suitable measures that shall cut down on disease incidence and its related impact [10].

**Results**

Surveillance systems in public health have been found to play an important role in detection and prevention of chronic diseases through generating important data that has helped the health sector globally. The findings of surveillance activities as concerning pattern and trends of diseases have been instrumental in shaping general preventive measures. This section presents the findings of several surveillance systems in relation to the threats to the health of the general population and underscores their significance for the prevention of chronic diseases.

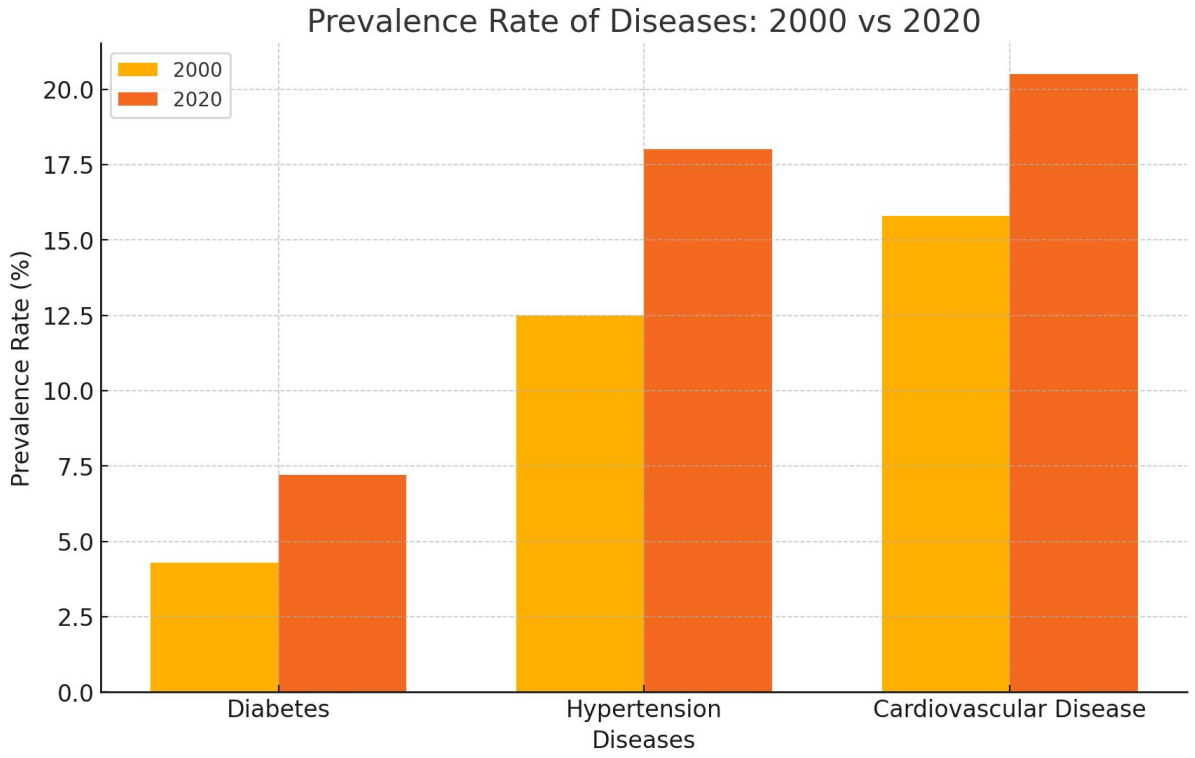
Surveillance has been of great help in early identification of chronic diseases in place especially systems of public health. For example, surveillance data on diabetes, cardiovascular diseases, and hypertension have led to an understanding of the patterns on affection and risks in targeted patient populations. These systems have often identified trends in incidence rates that are elevating long before they get to dangerous levels and thus prompt the need for public health interventions.

Surveillance systems also revealed that the incidence of diabetes has been rising at an alarming rate in the world. Monitoring the global trends shows that the incidence of DM has been increasing over the years especially in middle and low income countries now experiencing a diabesity epidemic. In many instances, this has been attributed to door to door mobility by cars, increased incidences of obesity and poor diet and other related factors that include lack of exercise. It has also helped in understanding more about geography and demography of disease, group prone to it as well as areas that require some form of intercession [11].

Likewise, high blood pressure has been recently determined through surveillance systems as a chronic disease with growing incidence. It should be noted that surveillance data has identified an alarming trend to hypertension prevalence among adults in developed as well as developing countries, most especially in the urban areas where these risk factors are most prominent and include changes in eating habits and physical inactivity. The surveillance systems have also affixed that there's a relative risk among some groups of people like the older people and those of a special colour. These early identifications have led to focused public health interventions in prevention and control of hypertension and its risk factors; heart attacks, strokes and kidney failures.

Table 1: Chronic Disease Trends Information Available in Surveillance Data (Example)

| Disease/Condition | Prevalence Rate (%) in 2000 | Prevalence Rate (%) in 2020 |
|---|---|---|
| **Diabetes** | 4.3% | 7.2% |
| **Hypertension** | 12.5% | 18.0% |
| **Cardiovascular Disease** | 15.8% | 20.5% |




Studies involving surveillance systems across countries such as the United States, United Kingdom as well as some Asian countries have provided trends for these that are upward and hence necessitating early detection and prevention efforts.

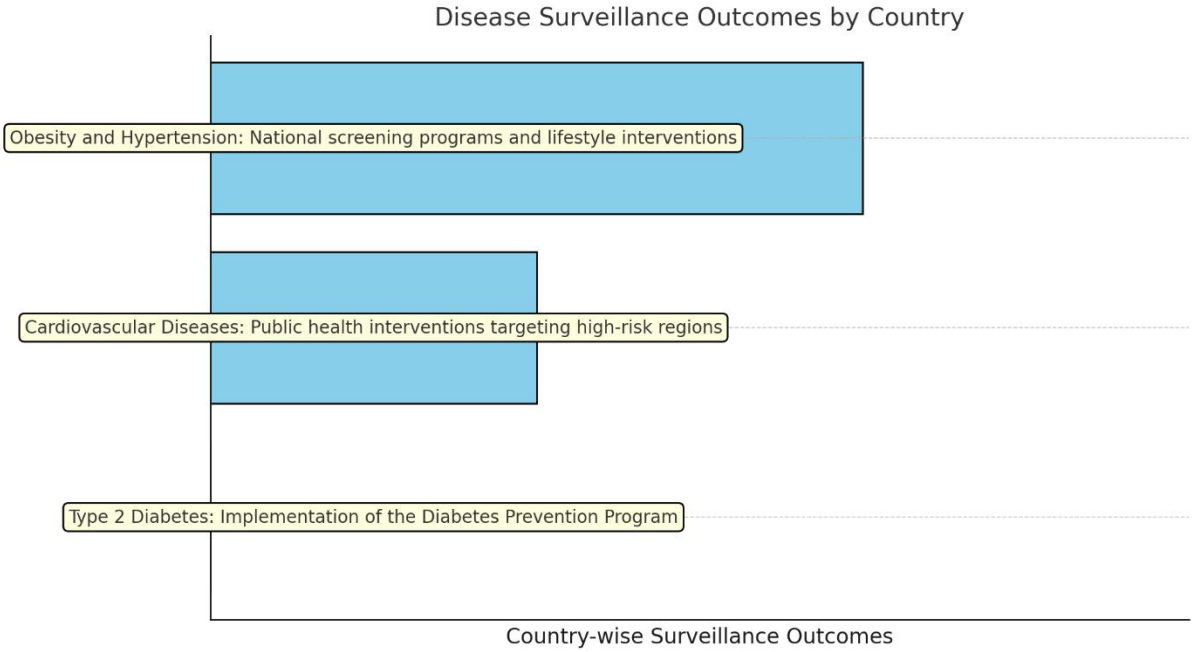
Surveillance has been identified to be central for identifying chronic diseases epidemic or perceived trends in the affected countries by cross-sectional analyses. The agencies that have paid great attention to the surveillance of chronic diseases include the CDC in the United States and several others here, there are some trends that have been identified, for instance, the increasing burden of obesity related diseases including type 2 diabetes. These findings led to the prove of several health national programs in the USA, for example the "Diabetes Prevention Program" which is meant to decrease the prevalence of type 2 diabetes through congressed lifetime physical activity and healthy diets [12].

On the same note, the UK's National Health Service (NHS) has relied on surveillance data to monitor cardiovascular diseases and the outcomes have been raised concerns, especially concerning the vulnerable population in the society. These data informed the need for make relevant lifestyle modification public health interventions such as health education crusades on healthy nutrition, quitting smoking, increased physical activities particularly in regions with high prevalence of the diseases. Also, surveillance data were used to ascertain the areas with high morbidity, mortality and prevalence rates especially those arising from complications arising from smoking related diseases such as lung cancer thereby calling for smoking control efforts spear headed by government.

Table 2: Surveillance systems in chronic disease detection: Two case studies

| **Country** | **Disease Tracked** | **Outcome of Surveillance Activity** |
|---|---|---|

| | | |
|---|---|---|
| **United States** | Type 2 Diabetes | Implementation of the Diabetes Prevention Program |
| **United Kingdom** | Cardiovascular Diseases | Public health interventions targeting high-risk regions |
| **Australia** | Obesity and Hypertension | National screening programs and lifestyle interventions |



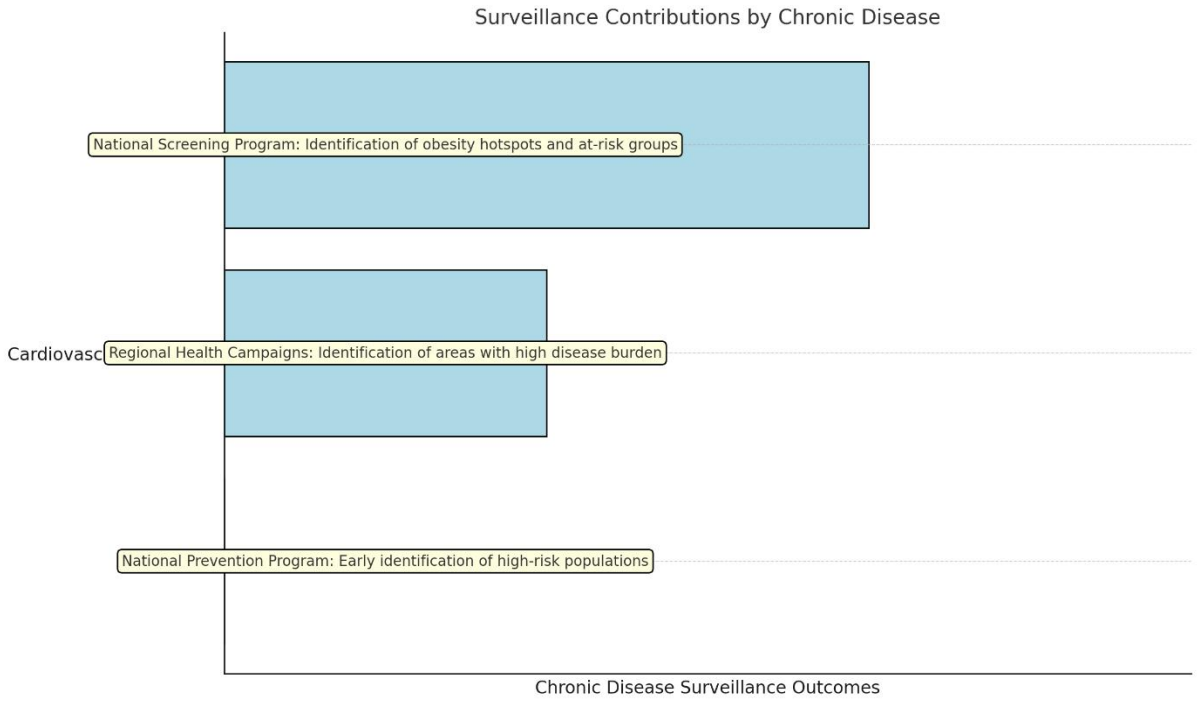

The source of surveillance data has provided direct impetus to several stratified intervention programs addressing chronic disease burden in the populations. These include the community-based interventions to the changes in behaviours such as smoking, diet, and physical activity. For instance, the United States of America's National Diabetes Prevention Program, informed by the Surveillance, proposes to involve at-risk communities educating them on aspects of change in lifestyles that can deter development of type 2 diabetes [13].

Likewise, in many countries, surveillance has guided the establishment of population-based screening of common conditions that affect the populace such as hypertension, diabetes, and some types of cancer. These programs mostly aim at early identification of symptoms and refer the patients to receive treatment services before the diseases digress further. For instance, in the United Kingdom, the National Health Service has implemented a national program for screening diabetes, which, based on surveillance ones, informs high-risk populations and provides them as early diagnosis and prevention.

Political influence is also a function of public health surveillance. For instance, the findings from hypertension surveillance have been used to develop policies on food product standards, which address standards of salt; built environment; and access and use of healthier food choices and active transport like walking and cycling. The problem with many of these measures is that they are precautionary in the sense of trying to remove specific risk factors that can lead to chronic diseases.

Table 3: Effectiveness of surveillance in managing public health activities

| Chronic Disease | Intervention | Surveillance Contribution |
|---|---|---|
| **Diabetes** | National Prevention Program | Early identification of high-risk populations |
| **Cardiovascular Diseases** | Regional Health Campaigns | Identification of areas with high disease burden |
| **Obesity** | National Screening Program | Identification of obesity hotspots and at-risk groups |



The returns to employ preventive measures such as surveillance include With undue stress made to jumper's economic and health gains on the early detection and prevention-. Pre-identification of chronic illnesses including hypertension, diabetes, and cardiovascular diseases can greatly reduce the cost of treating the diseases before worsening. For instance, to control hypertension in a patient is more economical than handling a patient who develops a stroke as a complication of hypertension. Likewise, early sign detection of diabetes can minimize the chances of now deadly diseases like renal failure, blindness or amputations that demand costly rigorous medical procedures [14].

For example, a National Diabetes Prevention Program conducted in the United States evaluated the cost of the program as well as the time taken in prevention and later compared it to the cost of managing a typical diabetes case. Such studies have also been performed in other countries, and it was noticed that most of the investments in early chronic disease prevention and screening, it leads to cost effective and overall benefits in terms of quality of life of patients and decrease in healthcare costs in long run.

Therefore, surveillance systems in public health have become more useful and effective in the early diagnosis of chronic diseases. In addition to discovering details about disease patterns and contributing factors, surveillance data help inform preventive measures that can greatly diminish the impact of chronic diseases on people and health care systems. These systems have been effective through achieving targeted health program goals, §policies and cheap intervention measures [15].

**Discussion**

Population-based surveillance is a crucial approach toward the early identification, tracking of and prevention for chronic diseases. But the ability of employee-icon commercialization strategies is generally limited by several factors and drawbacks. It is imperative for strategies that will increase the effectiveness of surveillance to be understood given the above challenges. In this part of the paper, challenges to surveillance systems, reasons for aggregating surveillance data with the health system, and recommendations will be presented.

However, data quality and data completeness remain one of the most important problems in the field of public health surveillance. Population based surveillance data is usually gathered from health facilities, laboratories, and public health departments. But there are several limitations in recording the information, including the existence of different reports, non-availability of uniform means of data collection, and tendencies of underdiagnosis of some diseases. For instance, in passive surveillance systems, healthcare providers may not report some specified chronic diseases because they are not well trained, do not know, or do not have adequate means to report the diseases. In addition, surveillance data may be therefore not representative of marginalized or under-represented groups who may have limited access to health services or who may not participate in health programmes. A lack of a good and large sample of data may put a more skewed and poorer picture of how diseases are manifested and impact on the intervention measures to be put in place.

Two other critical areas of difficulty include health care and disparities in surveillance. Healthcare has a central role in participation in health surveillance by a population. Many a time, especially in the developing or the rural areas, the community may never get access to the health facilities, or even in case they get access, they may never afford the bills that come along with visiting the hospital. This makes the acquired data amount to crying on the balance incomplete and inadequate especially for chronic disease which demand continuous treatment and follow up. In some cases, people at certain categories of risk or within a specific age group, gender or disease may be more prone to chronic

diseases- for instance people in poverty or of certain racial or ethnic origin. These groups may also be characterized by low involvement in surveillance programs that heightens health disparities and limits the assessment of the actual disease burden within those populations. Surveillance systems, therefore, require formulation in such a manner that will accommodate all people especially those in the high-risk groups of chronic diseases [16].

Lack of privacy, as well as ethical issues, also remains major challenges in public health surveillance. The collection, storage, and analysis of personal health data are privacy sensitive since personal privacy when it comes to their health data may be violated. In surveillance, large data is usually compiled from the general public and these may contain information on people's health status. It is also important to facilitate that surveillance systems are implemented ethically and legally thanks to guidelines like the US HIPAA, or EU's GDPR. There needs to be some kind of policy that can dictate how data is gathered, who can use it, and for how long it can be kept. Similarly, the public can be assured the applicability of the above principles for the use of personal health data for public health purposes gagging such data from the general public, can still be accompanied by attempts to gain the public trust in surveillance and other programs.

Combining public health epidemiological systems with clinical medical systems holds the prospects of providing dramatically superior achievement in patient care. With access to data obtained by surveillance and integration of the results into EHR and clinical databases, the healthcare providers have an opportunity to receive more real-time view of the populations' health situation, recognize more novel threats to public health, and distribute resources and efforts more efficiently. Through such integration it becomes easy for the information to flow freely from the public health authorities to the health care providers which in turn enhances the early identification of the chronic diseases as well as seamless care coordination . For example, using surveillance data and putting it into EHR systems in cases of hypertension or diabetes, helps clinicians to have a clue of vulnerable patients and to teach as well as prescribe lifestyle changes and recommended medications, frequent follow up [17].

Additionally, the implementation of surveillance systems connected to clinical systems may improve the capacities of the observation of the disease path in patients, observation of the efficacy of the applied treatment, and estimation of the general health state. Due to surveillance- clinical data integration the care of chronic diseases for which the patient requires follow-up care such as diabetes is enhanced, as it will be made according to the patient's need. It also enables the health care systems to assess shortcomings in the care process and guarantee that clients are receiving right treatment. Finally, the systematic integration of surveillance with systems of healthcare can only benefit the patient through early diagnosis, reduction of the gaps in the delivery of quality health care, and better management of the disease burden.

List of Measures for Enhancing Surveillance Systems

However, if some principal recommendations are to be followed, varied barriers and drawbacks of the existing public health surveillance settings can be resolved in the following manner.

Enhancing Data Collection Methods: The ways of gathering data needs to be enhanced as inaccuracy and incompleteness of the results obtained can compromise surveillance. This can only be done by having universal guidelines in the gathering of healthcare data and making sure all the healthcare organizations have the correct methods of presenting health data. Consequently, public health surveillance systems should employ more detailed information such as health surveys, national registries, population health data and the like. Sometimes, remote monitoring devices, for example, bracelets can give quick health information that can supplement a regular report system to reduce gaps

in reporting.

Strengthening Collaboration Between Health Agencies, Researchers, and the Public: Surveillance has to be coordinated by and with government health agencies, public health organizations, those in the healthcare delivery systems, and researchers. Better collaborations, data exchange, and multi-disciplinary research could help these groups enhance the kind of surveillance that is being done. Additionally, it is possible to engage the community in the surveillance initiatives within community based monitoring that would assist in surveillance in promoting the actuality of the status of health of the oppressed groups of the population.

Leveraging Emerging Technologies: Several new technologies like the AI, machine learning, MH apps have the potential to boost the validity and up-to-date nature of public health surveillance mechanisms. Big data analysis, trend analysis and predictive analysis or health reviews, disease proneness or changes, disease outbreak risks etc., all are possible with AI and machine learning algorithms. For instance, AI-based instruments may use social media messages, search engine keywords, and other informational plentiful sources to identify initial signs of emerging disease epidemics or other shifts in behaviour associated with chronic disease risks. Smartphone application and wearable gadgets can therefore alert stakeholders in real time regarding persons' health related activities including exercise, eating habits and sleep actions thus helping to check on chronic diseases. These technologies can assist healthcare providers and public health agencies to be much quicker at identifying new disease threats and applying treatment to change the course of a lifestyle that leads to the development of chronic diseases.

In sum, there are several challenges that are associated with the life of public health surveillance systems such as, data quality, access, and privacy, therefore, the surveillance systems can play a key role in early identification of chronic diseases. The linking of surveillance data into the existing health care systems and will enable the increased efficiency of using new technologies in surveillance. Public health authorities can improve chronic disease surveillance, detection, and response through the implementation of the recommendations suggested above improving population health outcomes around the world [18].

## Conclusion

Routine public health surveillance systems are important in the diagnosis, tracking and control of chronic ailments, which help providers to detect trends, mobilize resources, and apply appropriate measures. These systems assist in identification of new health risks, monitoring of health conditions and decreasing of sickness incidence and causalities. Nevertheless, there are formidable issues regarding data quality, unequal healthcare accessing, and ethical issues that should be solved for enhancing the efficiency of surveillance. Transition of old technology surveillance systems, increasing coverage and providing equal access to health facilities and services constitutes core tenets of enhancing health status of a population. In the future, it is important to continue strengthening and developing new forms of surveillance that work closely with artificial intelligence and applications in the field of mobile health to collect updated data immediately. Focusing on surveillance systems we must prevent the burden of chronic diseases in all populations and pave the way to healthier people in the future.

## References

[1] K. Chen, "Process mining and data mining applications in the domain of chronic diseases: A systematic review,"*Artificial Intelligence in Medicine,* vol. 144, p. 102645, 2023.

[2] M. Burnier, "The role of adherence in patients with chronic diseases,"*European Journal of Internal Medicine,* vol. 119, pp. 1-5, 2024.

[3] M. A. N. Saqib, "Effect of COVID-19 lockdown on patients with chronic diseases,"*Diabetes & Metabolic Syndrome: Clinical Research & Reviews,* vol. 14, no. 6, pp. 1621-1623, 2020.

[4] Y. V. Chudasama, "Impact of COVID-19 on routine care for chronic diseases: A global survey of views from healthcare professionals,"*Diabetes & Metabolic Syndrome: Clinical Research & Reviews,* vol. 14, no. 5, pp. 965-967, 2020.

[5] Y. Song, "Macrophage-targeted nanomedicine for chronic diseases immunotherapy,"*Chinese Chemical Letters,* vol. 33, no. 2, pp. 597-612, 2022.

[6] V. Gautam, "Health literacy, preventive COVID 19 behaviour and adherence to chronic disease treatment during lockdown among patients registered at primary health facility in urban Jodhpur, Rajasthan,"*Diabetes & Metabolic Syndrome: Clinical Research & Reviews,* vol. 15, no. 1, pp. 205-211, 2021.

[7] M. K. Al-Hanawi, "Willingness to receive COVID-19 vaccination among adults with chronic diseases in the Kingdom of Saudi Arabia,"*Journal of Infection and Public Health,* vol. 14, no. 10, pp. 1489-1496, 2021.

[8] S. M. Lagoumtzi, "Senolytics and senomorphics: Natural and synthetic therapeutics in the treatment of aging and chronic diseases,"*Free Radical Biology and Medicine,* vol. 171, pp. 169-190, 2021.

[9] D. Lin, "The microbiome as a major function of the gastrointestinal tract and its implication in micronutrient metabolism and chronic diseases,"*Nutrition Research,* vol. 112, pp. 30-45, 2023.

[10] G. Yang, "Physical activity and social support mediate the relationship between chronic diseases and positive mental health in a national sample of community-dwelling Canadians 65+: A structural equation analysis,"*Journal of Affective Disorders,* vol. 298, pp. 142-150, 2022.

[11] F. Karl Nadolsky DO, "American Association of Clinical Endocrinology Consensus Statement: Addressing Stigma and Bias in the Diagnosis and Management of Patients with Obesity/Adiposity-Based Chronic Disease and Assessing Bias and Stigmatization as Determinants of Disease Severi,"*Endocrine Practice,* vol. 29, no. 6, pp. 417-427, 2023.

[12] A. Shanmugasundaram, "Toward Point-of-Care chronic disease Management: Biomarker detection in exhaled breath using an E-Nose sensor based on rGO/SnO2 superstructures,"*Chemical Engineering Journal,* vol. 448, p. 137736, 2022.

[13] Z. Zainal, "Therapeutic potential of palm oil vitamin E-derived tocotrienols in inflammation and chronic diseases: Evidence from preclinical and clinical studies,"*Food Research International,* vol. 156, p. 111175, 2022.

[14] S. Uddin, "Comorbidity and multimorbidity prediction of major chronic diseases using machine learning and network analytics,"*Expert Systems with Applications,* vol. 205, p. 117761, 2022.

[15] T. M. PhD, "Association of Affirming Care with Chronic Disease and Preventive Care Outcomes among Lesbian, Gay, Bisexual, Transgender, and Queer Older Adults,"*American Journal of Preventive Medicine,* vol. 64, no. 3, pp. 305-314, 2023.

[16] C. Jiang, "Linking chronic diseases, cognitive impairment and depressive symptoms in Chinese older adults: A three-wave population-based longitudinal study,"*Journal of Affective Disorders,* vol. 324, pp. 496-501, 2023.

[17] P. Pellanda, "Understanding the impact of age-related changes in the gut microbiome on chronic diseases and the prospect of elderly-specific dietary interventions,"*Current Opinion in Biotechnology,* vol. 70, pp. 48-55, 2021.

[18] C. Zheng, "Biomarker-Calibrated Red and Combined Red and Processed Meat Intakes with Chronic Disease Risk in a Cohort of Postmenopausal Women,"*The Journal of Nutrition,* vol. 152, no. 7, pp. 1711-1720, 2022.