IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

The Role of Medical Coding in Epidemiology and Public Health Surveillance

Mr. Umesh Premdas Jadhao, Mrs. Gauri Bhudeo Jathe
Dr. Abhijit V. Shrirao, Dr. Anil. V. Chandewar
Yavatmal Zilla Vikas Samiti's Pataldhamal Wadhwani College of Pharmacy, Yavatmal, Maharashtra, India.

Abstract: *Medical coding plays a crucial role in epidemiology and public health surveillance by transforming clinical information into standardized codes, facilitating accurate data collection, analysis, and reporting. It ensures that health events, diagnoses, and procedures are consistently documented, enabling the identification of disease patterns, trends, and outbreaks. With systems such as ICD (International Classification of Diseases) and CPT (Current Procedural Terminology), coding helps in monitoring the incidence and prevalence of diseases, tracking healthcare outcomes, and evaluating public health interventions. Moreover, coded data supports early warning systems by providing timely alerts about emerging threats, such as pandemics or antibiotic-resistant infections. The integration of coded health data into electronic health records (EHRs) and national health databases promotes efficient data exchange and comparison across regions and countries, which is essential for coordinated global health responses. Furthermore, medical coding aids in resource allocation, policy-making, and research by providing reliable epidemiological data for decision-makers. However, coding inaccuracies and inconsistencies can impact data quality, highlighting the need for skilled coders and continuous training. In summary, medical coding is indispensable for effective epidemiological surveillance, contributing to evidence-based public health strategies*

Keywords: Medical coding, epidemiology, public health surveillance, ICD, data quality, disease monitoring, EHR, global health

I. INTRODUCTION

Medical coding has importance as it aids the processes of data collection and analysis within epidemiology and health surveillance. Systems for conversion of healthcare prognoses into the accepted alphabets and figuresthe so-called medical coding – helps to describe and restore health records and other materials. This is useful for determining the occurrence of illness, the progression of illnesses and the growth of health facilities.[01]

There are several uses of coded data in epidemiology, including detecting outbreaks or mediocre disease transmission, and assessing whether health measures taken have had the desired effect. For example, in regard to codes for infectious diseases, there is tracking of cases, which simplifies the responses made to outbreaks and hence better outcomes in public health are achieved. In addition, data on coverage and affordability enhance planning, implementation, and evaluation in as far as quality and utilization of health services are concerned.[02]

In addition, Public Health Surveillance defends itself on coded health data in decision making and health threat reducing strategy formulation. Health information system also encourages other epidemiological information such as policies of various diseases.[02]

II. IMPORTANCE OF MEDICAL CODING

Uniform disease classification and documentation of diseases, conditions, and healthcare interventions through medical coding give it an extremely important place in epidemiology and public health surveillance. This helps in the systematic coding, analysis, and reporting of large-scale health trends to the advantage of healthcare service providers and health authorities.[05]

- **Data Standardization: -** Systems of medical coding such as ICD (International Classification of Diseases) and CPT (Current Procedural Terminology) have provided the standardized language necessary for

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

documenting diseases, procedures, and services across the spectrum of healthcare systems. Like this level of standardization, the consistency in reporting health-related data is very important for epidemiological studies and surveillance.[03]

- **Disease Surveillance and Outbreak Detection: -** Medical codes would give early indications of trends in the occurrences of diseases that can enable the development of early warnings. This is very critical to mount early public health responses, for example, interventions concerning communicable diseases such as influenza, COVID-19, or antimicrobial resistant infections. [03]
- **Health Trend Analysis: -**An epidemiologist may analyze the coded health data for long-term trends in disease prevalence, mortality rates, or treatment outcomes for use in developing preventive interventions, public health policies, or resource allocation strategies. [05]
- **Policy and Program Development: -** Governments and public health agencies rely on coded data to help determine the burden of diseases and health conditions within a population. The data serves as the foundation upon which public health programs and policies should be developed to prevent disease, promote health, and provide access to healthcare. [04]
- **Quality Control and Audit: -** Medical coding aids in quality assessment by tracing patient outcomes, complications, or medical mistakes. These records become highly important for audits, compliance verification, and other similar purposes to ensure healthcare is conducted according to the prevailing public health Guidelines.[04]

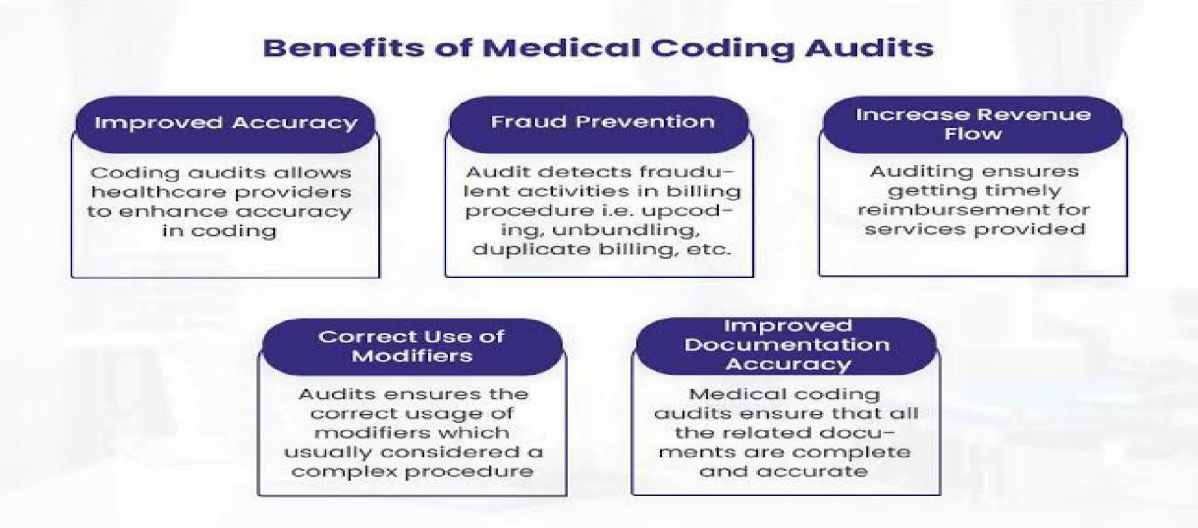

Fig 1: Benefits of Medical Coding Audits

III. ROLE OF MEDICAL CODING IN EPIDEMIOLOGY-

Medical coding aids in the monitoring of diseases as it delivers structured, standardized data that healthcare systems trace for public health tracking and the observation of disease outbreak trends as well as healthcare trends. Here is a more detailed breakdown of this role:

1. Standardization of Health Data

Medical coding systems like ICD (International Classification of Diseases) and CPT (Current Procedural Terminology) provide standardized documentation of diagnosis, treatments, and procedures in different healthcare providers. It allows for uniform tracking of diseases regardless of location or healthcare institution. [04]

2. Epidemiological Surveillance

Precise coding ensures that public health agencies like the CDC and WHO can track the incidence and prevalence of diseases. For instance, ICD codes of infectious diseases like COVID-19 assist in tracing outbreaks and incidence patterns of spreading diseases across different regions. [04]

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

3. Real-Time Tracking

With EHRs and real-time coding systems, the disease case report may be reported quickly, which ensures that public health interventions are made timely. The system is timely in reporting pandemics or emerging infectious diseases to take necessary control measures right away.[04]

4. Resource Allocation Improvement

But if one traces disease patterns by using coded data, governments and health organizations can ensure that better allocation of resources takes place-that vaccines, medical supplies, and health-care providers are directed to areas where disease trends increase. [07]

5. Conducting Disease Research and Policymaking

Data from patient records, encoded by medical coders, helps researchers and analysts identify trends and possible risk factors or outcomes for diseases. Such evidence supports creating informed decision support for health policy improvement where resultant population health outcomes are evidence-based.

Example**: Tracking COVID-19 Disease**

New ICD codes were also introduced during the COVID-19 pandemic. For instance, COVID19 was included in code U07.1. This would track the disease globally, ensuring that correct and standardized data were available, so health organizations could monitor infection rates, hospitalization trends, and mortality rates-the three of which would inform public health responses.[06]

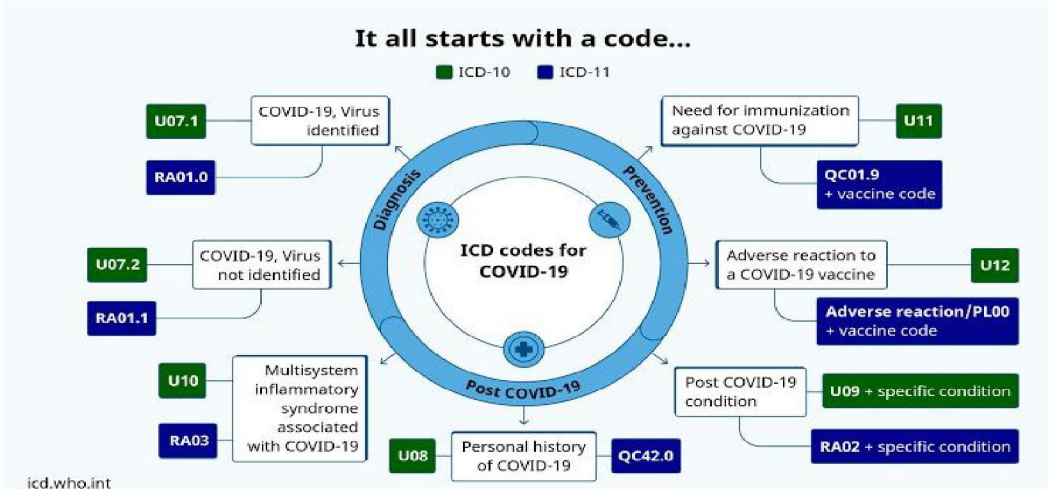

Fig 2: ICD Codes For COVID-19

Medical coding can also highly contribute to the identification and management of outbreaks by providing standard methods for capturing, categorizing, and analyzing health data. Here's how it contributes to the identification of outbreaks as well as references: [08]

1. Standardization of Data: -

Standardization of health data will refer to such medical coding systems as the International Classification of Diseases and Current Procedural Terminology. This will assist in reporting and tracking diseases uniformly for surveillance purposes, which is crucial in the case of outbreak. [08]

2. Support Surveillance: -

Accurate coding helps public health agencies to track the disease pattern and trends. Surveillance systems rely on the use of coded data to monitor the rise or uptick of specific diseases that could signal an outbreak.[08]

3. Data Aggregation and Analysis: -

Coded health records can be aggregated for epidemiological analysis. This can determine the cause, spread, and effects of outbreaks. [08]

4. Identifying High-Risk Populations: -

Medical coding establishes demographics most affected by an outbreak, which helps tailor focused public health interventions and resource allotment. [08]

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

5. Reporting to Health Authorities: -

Healthcare providers report cases to health authorities using coded information. This makes for prompt response and outbreak management at the local, national, and global levels. [08]

6. Improving Clinical Practices: -

This will help in identifying trends in clinical practices and results in case of outbreak as medical coding enhances treatment protocols and guidelines. [0]

Medical Coding in Risk Factor Analysis: -

Some ways contributing to 'risk factor analysis' are:

Diagnosis-related risks: - The medical codes, mainly ICD, CPT, and HCPCS classify the condition of the patient, procedures, and comorbidities. These codes allow for the proper identification and quantification of the risk factor that characterizes a specific condition such as 'hypertension', 'diabetes', and 'smoking' in cardiovascular diseases. [12]

Standardization of Large Populations: -Data Medical coding enables standardization of health information so that data from different populations can be aggregated for analysis and drawing conclusions. The process, therefore, allows for vast-scale analysis in terms of trends but also associations between risk factors and outcomes, supporting population health management. [12]

Tracking and Anticipating Outcomes: - Because risk factors based on coded data are linked to health outcomes, medical coding can allow one to track or anticipate which of the risk factors contributes to morbidity and mortality. For instance, tracking the impact that chronic diseases such as diabetes have through ICD-10 codes helps to inform such factors in terms of what it contributes to patient outcomes.

IV. ROLE OF MEDICAL CODING IN PUBLIC HEALTH SURVEILLANCE

The point at which medical coding intervenes is indeed crucial in monitoring health outcomes, it gives an avenue to capture and analyze health data in a standardized and structured manner. Here is how it supports this process:

Data Consistency and Accuracy

Healthcare clinical data, diagnoses, treatments, and procedures are standardized in codes, including ICD (International Classification of Diseases), CPT (Current Procedural Terminology), and HCPCS (Healthcare Common Procedure Coding System). Such a standardization will have results as uniform data gets from health providers and systems. That is, it will be possible to track health outcomes reliably as well as for comparison. [06]

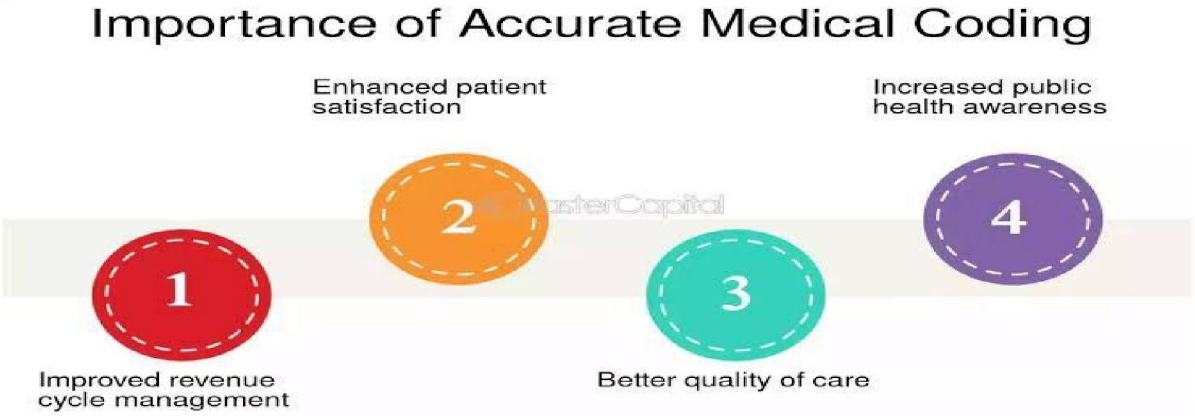

Fig 3: Importance of Accurate Medical Coding

Disease and Treatment Patterns Tracking: -

Through coding, one can establish trends in disease prevalence, patient demographics, treatment outcomes, and complications. Public health organization-coded data can be used to monitor the effectiveness of interventions and healthcare services across populations. [11]

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

Public Health Reporting: -

Medical codes are helpful in reporting notifiable diseases to public health agencies. It is useful information for monitoring the outbreak, assessing the impact of vaccination programs as well as tracking other interventions in the health sector. For instance, codes that relate to infectious and chronic conditions help in disease burden monitoring.[11]

Healthcare Quality Monitoring: -

Through coded data, areas of health outcomes that involve readmission rates after treatment from hospitals, death, or complications post-treatment can be monitored and thus graded for healthcare quality improvements. Areas of development can be pointed out. For example, coded data can indicate patterns in hospital-acquired infections, cases of readmissions relating to surgical complications, and drug reactions that are adverse. [11]

Research and Clinical Studies: -

Such encoded health information are considered to be used by the researchers for clinical analysis, and they are provided with an opportunity to understand the effectiveness of treatment and to interpret patient outcomes and development of diseases. For example, large-scale studies related to the effectiveness of new treatment or intervention can be performed using encoded data available related to patient outcomes. [11]

V. MEDICAL CODING IN PLANNING OF HEALTHCARE RESOURCE ALLOCATION-

The best part of this process is that it makes it easier for proper resource planning in health care using the translation of clinical data into standardized codes, which helps in proper decision-making. The standardized information offered by such codes is invaluable to decision-makers concerning allocating resources. Here's how medical coding functions in resource allocation: [14]

Data Standardization in Resource Planning

Medical coding will achieve standard health data that is workable for hospitals, insurance agencies, and government units to analyze trends in health care utilization. For example, ICD (International Classification of Diseases) will aid policymakers to see the actual prevalence of diseases and areas of high demand, hence leading to good resource distribution. [14]

Financial Reimbursement and Budgeting

This practice in many countries is directly related to the systems of billing and reimbursement. Its effects directly influence how health care providers are reimbursed for all the services provided them, hence allowing them to properly budget and plan their activities. This is, once more, going to affect, in turn, how the health care facilities will prioritize the allocation of their resources in terms of staff and equipment, among other resources. [14]

Public Health Surveillance and Policy Development

Medical coding has the significant role in public health initiatives in tracking disease outbreaks and chronic conditions. One example of how health departments can identify disease prevalence patterns and allocate either vaccines or public health interventions to where they need to be is through the use of codes. [14]

Performance and Efficiency Monitoring

Medical coding also aids in monitoring the performance of health care providers and the effectiveness of resource use. With encoded information, administrators in healthcare can identify cost-effective treatments or services and subsequently assign funds appropriately.[14]

Focus on Key Areas

The same coding data can show which populations or areas need more health service resource, including specialized equipment or staff. For instance, an area coded with high numbers of chronic diseases may require more resources in the primary care level.

A WHO report Indicated that the ICD codes were vital in tracking the global trends of diseases and directing the way in which resources about health should be utilized in a given outbreak. [14]

VI. DEVELOPMENT OF POLICY AND IMPLEMENTATION

Medical coding is the process by which patient data is translated into standardized codes. It, therefore, helps policymakers in health systems study health trends, resource utilization, and outcomes. Here's how medical coding impacts policy development: -

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

1. Data standardization and surveillance: -

It ensures healthy documentation of health conditions, treatment, and outcomes on universally accepted systems such as ICD(International Classification of Diseases) or CPT(Current Procedural Terminology). [14]

Policy Impact: -These standardized data can be used by the policymakers for the public health surveillance, identification of patterns of disease, health inequities, and burden of various diseases at both national as well as international levels. This would further support resource allocation, preventive care programs, and vaccination campaigns.

2. Resource Allocation and Budgeting: -

Medical coding provides information on the number of hospitals that exist, their cost of service, and the patients' demographics. The coding can be used to trace how the available resources are consumed and used to budget for health programs. [14]

Policy Impact: Analysis of data from medical coding assists governments inFormulating funding policies for hospitals or determining the rate at which different medical procedures will be reimbursed under national health insurance schemes.

3. Quality of Care and Clinical Guidelines: -

Codes help track outcomes, complications, and efficacy of treatments, thus performance measures.

Policy Impact: Quality information gathered from the coding systems can be used in formulating clinical guidelines and standards of care,Policymakers might reward adherence to the guidelines or penalize hospitals with higher than anticipated rates of complications. [14]

4.Reimbursement Models and Health Insurance: -

Medical Coding has a major role in billing and claims processing. Furthermore, classification of treatments and services gives rise to the reimbursement policies for payers-whether public or private.

Effect on Policy: Coding information insists on a shift from fee-for-service models to value based care, as coded data speaks directly to the decision to cut or add based on cost relative to quality of care. It should be noted that this shift is meant to reward providers for efficiency and good outcomes for their patients. [15]

Research and Healthcare Innovation: -

Coded data are widely deployed in epidemiologic studies and clinical investigations as an essential input for new treatments and innovations in the delivery of healthcare.

Policy Influence: Research information from medical coding can be used by policymakers to control the introduction of new medical technology and drugs, with the aim of ensuring that medical innovation is safe and cost-effective. [15]

VII. CHALLENGES IN MEDICAL CODING

From the epidemiology and public health surveillance perspective, there are some challenges in medical coding: -

- **Complexity of coding systems: -** The several coding systems are highly diversified in their structure and rules (e.g., ICD, CPT, SNOMED). Mastering these, especially when they relate to varied diseases and conditions, is quite a difficult task. [16]
- **Quality and Completeness of Data: -** Proper coding actually relies on full and correct clinical documentation. Misclassification may result due to incomplete or inconsistency in records that compromise the quality of surveillance data and epidemiological analysis. [16]
- **Terminology Variability: -**The same condition is coded differently by various health sector providers and thus results in a disparity in coding, therefore undermining data aggregation.[16]
- **Timeliness of the Data:** Epidemiological research often involves real-time or near realtime data. How the lag in coding impacts the opportunity to timely respond to a public health threat is another issue. [16]
- **Training and Expertise:** This would demand highly skilled coding experts who are equally well-trained in not only the systems used for coding but also in public health concepts. Unless proper training is offered to the coding experts, the whole process could result in incorrect and inconsistent collection of data. [16]

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

- **Data Sources:** Epidemiology includes inputting data from various sources, like hospitals, laboratories, and the departments of public health. This process is really very challenging due to the proper use of coding in varied datasets. [16]
- **Guidelines and Regulations:** The usual upgradations in coding guidelines and updates in public health regulations create confusion and require continuous education for coders and healthcare professionals. [17]
- **Privacy and Confidentiality Issues:** Coding deals with the sensitive health information. Sometimes, maintaining privacy concerning patient confidentiality while there is a need for suitable data output for surveillance in public health may be a trade-off. [17]

VIII. RECOMMENDATION FOR EMPHASIZING THE IMPORTANCE OF MEDICAL CODING IN EPIDEMIOLOGY AND PUBLIC HEALTH SURVEILLANCE: -

Here are some suggestions on how one can highlight the role of medical coding in epidemiology and surveillance practices in public health:

- **Harmonization of Coding Systems in Health Facilities**: - Standardized coding at all health facilities may standardize the data generated with regard to consistency, accuracy, and comparability. This will ideally be useful for improving public health surveillance as well as in epidemiological research. [18]
- **Continuing Education and Training**: - All medical coders, providers of healthcare, and public health professionals must have continuous education and training as a requirement. Such training courses should cover the most updated coding systems, public health concepts, and epidemiological methods so as to improve coding accuracy and interpretation of results.[18]
- **Enhanced Documentation Practices**: - As more healthcare providers begin documenting clinical care in more detailed and precise ways, the quality of coded data will increase. The use of checklists or guidelines for documentation can help providers capture very important patient information.[18]
- **Investments in Health Information Technology**: - The implementation of advance health information technologies, the most common being HER and coding software, significantly supports the processing work as well as error reduction in coding. These also have a potential for data transfer across systems which may bring even better integration of epidemiological data.[19]
- **Collaboration between Public Health Agencies and Service Providers: -**In that case, facilitating the flow of information can be made possible in case there exist public health agencies that collaborate with different healthcare organizations. A collaboration would facilitate better understanding of the coding requirements and public health priorities to lead to a surveillance outcome. [19]
- **Analytics and Data Visualization Application: -**Data analytics and visualization tools are applied in public health offices and epidemiology to interpret coded data. It can easily identify trends and outbreaks and serves to show some risk factors.[19]
- **Regular audits and feedback mechanisms**: - Regular audits of the coded data can help detect common errors or areas for improvement. Giving feedback to coders and healthcare providers helps them become accountable as well as continually improve their coding practices.[19]
- **Identifying the Impact of Coding on Public Health Results:** Rising awareness about the direct association between proper medical coding and effective public health interventions may be able to create a culture of accuracy. In simple words, as a case study of various situations, whereby quality coding has an impact on disease tracking and control, will rebuild its importance in the health sector. [20]

IX. CONCLUSION

Medical coding is very crucial in epidemiology and public health surveillance. In essence, correct and effective medical coding forms the backbone of data collection, analysis, and reporting against which decisions on public health policy and practice are made. By providing standardized classification of disease conditions, procedures, and health outcomes, medical coding becomes the foundation upon which health data can be aggregated across various systems and jurisdictions for easier tracking of disease trends, outbreaks, and disparities in health.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

Further coded data insights drive evidence-based decision making, resource allocation, and health intervention evaluation. In light of the ever-increasing complexity of public health challenges and concerns, the highly specialized skilled work of medical coders is now more vital than ever in ensuring the integrity and reliability of a country's health information system.

However, data quality, variability in terms, and the need for ongoing training make investment in robust coding systems and professional development for coders a must. Improvement over these challenges will enhance the overall effectiveness of public health surveillance efforts and impact health outcomes for populations.

In essence, then, providing accurate and quality medical coding practices in epidemiology and public health surveillance is the way to be supported to advance public health initiatives and to shape a healthier society. Continued emphasis on the coding importance will ensure that the public health professional has the trustable data to help stop health issues effectively and improve the well-being of the community.

X. SUMMARY

The Role of Medical Coding in Epidemiology and Public Health Surveillance

Medical coding, therefore is very key in epidemiology and public health surveillance because it enables systematic recording, classification, and analysis of health-related data. By use of standardized coding systems such as ICD and CPT, it ensures accurate documentation by healthcare providers for diagnoses, treatments, and procedures. This coded dataset aids epidemiologists in monitoring trends of diseases, trace outbreaks, and even identify emerging health risks.

Medical coding aggregates data from different places and times, a core part of public health surveillance, for cross-regional and time-series comparisons. It allows in real-time the monitoring of infectious diseases and chronic conditions and of the causes of death to provide for the timely detection of epidemics and call for timely interventions. Finally, medical coding aids in the evaluation of public health programs by ensuring that observed changes in population conditions are truly due to the interventions or not, through follow up in time of outcomes.

Accurate coding saves on error reports so that data used in policy, resource allocation, and research is reliable. It also improves data interoperability across hospitals, laboratories, and government agencies to promote working together. In a nutshell, medical coding is the back-bone of public health surveillance and epidemiology translating patient level information into actionable population health improvements.

REFERENCES

[1]. Hsia, R. Y., & Mendez, L. (2017). The Role of Medical Coding in Public Health Surveillance. American Journal of Public Health, 107(12), 1895-1896.

[2]. Rosenbaum, L. (2018). The Power of Medical Coding in Health Care. New England Journal of Medicine, 378(6), 521-523.

[3]. CDC. (2020). The Importance of Health Data in Epidemiology and Public Health Surveillance. Centers for Disease Control and Prevention. Retrieved from [CDC Website] (https://www.cdc.gov)

[4]. Hoffman, M. (2022). "Medical Coding for Epidemiological Research: Standardization and Surveillance." Journal of Public Health Data and Informatics.

[5]. World Health Organization (WHO). (2019). "International Classification of Diseases" (ICD). WHO.

[6]. Centers for Disease Control and Prevention (CDC). (2020). ICD-10-CM Official Coding Guidelines - Supplement Coding encounters related to COVID-19 Coronavirus Outbreak. Available at: [CDC Guidelines](https://www.cdc.gov/nchs/data/icd/COVID-19-guidelinesfinal.pdf)

[7]. World Health Organization (WHO). (2021). "International Classification of Diseases" (ICD). Available at: [WHO ICD 10 CM Overview](https://www.who.int/standards/classifications/classification-of-diseases)

[8]. Orenstein, W. A., & Ahmed, A. (2017). "Vaccination and Outbreak Response." In Vaccines (6th ed., pp. 150-162). Elsevier.

[9]. Groves, T., & McKee, M. (2011). "Health Information: Improving Public Health Surveillance." BMJ, 342, d3309.

[10]. Mena, K. D., & Lillibridge, K. (2021). "The Role of Medical Coding in Public Health." Journal of Public Health Management and Practice, 27(5), 431-437.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 5, Issue 3, January 2025

[11]. Thacker, S. B., & Stroup, D. F. (2007). "Surveillance: A Core Function of Public Health." Public Health Reports, 122(1), 44-51.

[12]. Butler, A. M. (2017). Medical Coding for Risk Factors: The Importance of Accurate Health Data. Journal of Medical Systems, 41(9), 145. https://doi.org/10.1007/s10916017-0775-y

[13]. Gagne, J. J., et al. (2012). Algorithm to Estimate Risk Factors from Electronic Health Records Using Medical Coding. *Pharmacoepidemiology and Drug Safety, 21(6), 611-618. httpsdoi.org/10.1002/pds.2247

[14]. 14. Fenton, S. H., & Biedermann, S. (2020). The Role of Medical Coding in Policy Development: A Global Perspective. Journal of Health Information Management, 15(3), 4553.

[15]. 15.Fitzgerald, R. (2020). "The Role of Medical Coding in Public Health Surveillance." Public Health Reports*, 135(2), 201-207. DOI: [10.1177/0033354920905874] (https://doi.org/10.1177/0033354920905874).

[16]. .Wheeler, A. P., & Riddle, B. (2018). "Challenges in Public Health Surveillance: The Need for Consistent Coding Practices." *Journal of Epidemiology and Community Health*, 72(3), 265-270. DOI: [10.1136/jech-2017-209118](https://doi.org/10.1136/jech-2017209118).

[17]. Centers for Disease Control and Prevention (CDC). (2021). "Public Health Surveillance and the Role of Medical Coding." Retrieved from [CDC website](https://www.cdc.gov/publichealthsurveillance).

[18]. Bohm, J., & Kuhlmann, A. (2021) "Standardizing Medical Coding Practices for Public Health Outcomes." Health Informatics Journal, 27(3), 146-154. DOI: [10.1177/1460458220958681] (https://doi.org/10.1177/1460458220958681).q

[19]. World Health Organization (WHO). (2020) "The Role of Health Information Systems in Public Health Surveillance." Retrieved from [WHO website] (https://www.who.int/publications/i/item/9789240011531).

[20]. Klein, A., & Elam, J. (2019)"Training and Resources for Medical Coders in Public Health: A Comprehensive Approach." Journal of Public Health Management and Practice, 25(1), E12-E61.