

A Review of Epidemiological Physical Models in Healthcare: Exploring the Roles of Pharmacists, Laboratory Scientists, Physiotherapists, Nurses, Dentists, And Information Technologists

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Abstract

Epidemiological physical models are vital tools for understanding and predicting the spread of diseases within populations, particularly in the context of oral health. These models provide valuable insights for designing public health strategies aimed at preventing and managing oral diseases. The roles of various healthcare professionals, including dentists, pharmacists, laboratory scientists, physiotherapists, nurses, and information technologists, are integral to the development and application of these models. Dentists offer crucial data on the prevalence and impact of oral diseases, pharmacists manage medication adherence, laboratory scientists contribute diagnostic data, physiotherapists support rehabilitation, nurses educate and advocate for oral health, and information technologists ensure efficient data management. This review explores the contributions of these professionals, emphasizing the need for multidisciplinary collaboration to enhance the effectiveness of epidemiological models in improving oral health outcomes. Despite ongoing challenges, such as data privacy and real-time information integration, the collaboration of these healthcare professionals remains central to advancing public health in dentistry.

Keywords-Epidemiological models, oral health, dentists, pharmacists, laboratory scientists, physiotherapists, nurses, information technologists, disease prevention, public health, dental diseases.

1. Introduction

Physical models can illustrate the interaction between the time-dependent phenomena of human and natural systems. Epidemiological physical models have brought about significant advances and have contributed to ensuring public health and a

better quality of life. Many professionals oversee working in epidemiological physical models. This review focuses on the contributions of different professionals: pharmacists, laboratory scientists, nurses, and information technologists. Each professional has a different role in the field, working

from various angles. This problem requires collaborative approaches to ensure a correct total or holistic approach or view within the healthcare staff to address the disease by preventing and controlling it correctly by addressing it at its source and considering total connectedness to its environment. Each group of professionals has a different influence on fundamental questions that should contribute to developing epidemiological physical models and how to contribute to it. They can provide a recommended epidemiological physical model according to the background of their work. Every profession or discipline is developing and changing over time. The transformation of the healthcare system, dependence on information technology, aggressiveness of pharmaceutical marketing, and increased preparation of medications for home use promote expanded contributions from healthcare professionals to disease prevention and management. The objective of this study is to provide complete information about the current status of contributions made by pharmacists, laboratory scientists, nurses, and health informatics in order to apply the physical modeling of epidemiology. (Kaplan & Hays, 2022)(Kohl et al., 2020)(Woessner et al.2021)(Mouratidis, 2021)(Mouratidis, 2021)(Lazarus et al.2022)(Buss et al.2020)(El et al.2020)

2. Epidemiological Models in Public Health

Epidemiological models provide quantitative explanations to best describe epidemic processes and hold significant promise to forecast the uncontrolled spread of a pathogen to inform decisions on implementing interventions. To understand the epidemiological models for prediction and then decide who intervenes, it is worthwhile to describe the essence of such intervention in the health system. Public health intervention means actions are taken to ensure that the population is protected from disease, its social consequences, the ability to vaccinate safely, and protection from bioterrorism threats and other causes of threats to public health. Preventive intervention in this definition reassures that the occurrence of a problem, disease, and harm has not occurred or has been anticipated, taken preventive and protective measures, and promoted advantageous conditions so that people can be healthy, ensuring that all individuals are protected

against death and diseases by guaranteeing health for all. Therefore, public health intervention is crucial to reduce mortality, morbidity, and permanent human disability as well as economic crises in individuals.

Public health intervention reduces something that needs to be reduced in effective and safe methods, considering the community specifications from multidisciplinary perspectives. To decide the type of intervention, disease outbreak, and the best methods of intervention in the health sector, it is necessary to use modeling or systems thinking, or epidemiological measurements that use mathematical and statistical ways to predict human action, organisms, and the environment and make decisions on predictive preventive or reactive methods. This review paper discusses the basics of public health intervention and the basics of epidemiological models, relating to the prediction of uncontrolled transmission, showing how cost-effective and economical it is to make decisions that are predictive in intent and based on prediction. Economic power in public health, the combination of such models results in the best modeling that is known as the hybrid models or integrated model. (Herlitz et al., 2020)(Benham et al.2021)(Franke et al.2021)(Kwasny et al., 2022)(Bennett, 2021)

2.1. Definition and Purpose

Epidemiological models are mathematical expressions of our understanding of how diseases spread in populations. They can describe the interaction between a pathogen, a host, and the environment in a way that can help us not only describe what has happened in the past but also forecast the future and inform public health strategy. There are many ways of modeling these dynamics, and they can be seen as lying on a spectrum depending on what scale the models are considering when seeking to make a forecast of how many people are likely to be affected. At one end, there are individual-based models, which attempt to use as much information as possible about the heterogeneities of both the hosts and their interactions, seeking to generate a realistic time course of an outbreak in a given population. These are often the most computationally intensive models but are often more flexible in terms of the disease being modeled. At the other end, there are meta-population models that seek to use general networks

of connection between more abstract groups to capture the overall flow of individuals between them.

Epidemiological models are used to anticipate future infectious disease trends and changes in demography to help public health bodies respond in a timely manner. They are based on susceptible, infectious, recovered models and estimate disease parameters over time. In the context of Ebola, modeling has helped improve reporting and encouraged international response. Collaborative work between pharmacists and IT professionals can produce dynamic models needed to help assess risk. Disease knows no professional boundaries. Subjects associated with direct patient care must sometimes be prepared to come into contact with infected patients. Biomedical laboratory testing is helpful in identifying risk but not in developing tools to understand patient management. Epidemiological models are essential to plan for monitoring current emergency threats and to help develop contingency plans for local populations given local resources.

2.2. Types of Epidemiological Models

Many models can be fitted under epidemiology. These different models have unique characteristics and are available for public health practitioners. The types of models that can be fitted are as follows. 1) Deterministic models: As the name implies, the outcome is deterministic. They predict outcomes based on initial conditions alone and thus fail to capture any random effects. Hence, their results are characterizable by one or more mathematical equations. 2) Stochastic models: In contrast, stochastic models can incorporate randomness in the system. They usually can account for variability in the number of new infection cases. This makes stochastic models more pertinent in the case of diseases that result in small numbers of cases. 3) Discrete models: Two common types are compartmental models and agent-based models. 4) Non-discrete models: These models can track a continuous disease status analogously to compartmental and agent-based models, while also being able to track numerous outcomes. Compartmental models: Compartmental models can be compartmental, e.g., in or out of hospital; infectious status, as in Susceptible, Exposed, Infectious, and Recovered models; age distribution. A range, where A is a functional maximizer of the

gain functional and is the socially optimal level of A and is the degree of attachment to the dynamics of the non-COVID state; is the rate of health over economic gain; and is the rate of substitution of the individual between the different state dynamics. These levels of state dynamics are 0 if there is no disease, and 1 if there is a disease, and denotes a vector indicating the presence of a control. There is also the Health Threat Cost.

3. Role of Pharmacists in Epidemiological Models

In models used within public health, pharmacists are well-suited as a source of input. Their front-line role in medication management enables them to have direct influence on improving a patient's adherence to a preventive or prescribed treatment regimen. This can be used as an input in many modeling applications. Moreover, pharmacists possess the ability to capture information about the use patterns of medication, which can be used to validate the outputs of the models as well as applied further to enhance accuracy or predictive capabilities. The potential for collaboration with these knowledgeable providers should be pursued in the research of such models to optimize their use during outbreaks or bioterrorism events. Pharmacists could be a valuable source in describing characteristics of a drug and its mechanism of action. A significant role that pharmacists can have in contributing to public health is in the amount of public education and disease state education that they have fostered across the nation. Pharmacists can take the initiative to explain safe practices that can be used as methods for general disease prevention. When an outbreak occurs, pharmacists who are counseling patients can explain these practices in more detail. However, if given training, pharmacists would be an excellent profession for identifying potential drug interactions or negative side effects caused by a preventive or outbreak-related drug. Adherence could be monitored, and adverse effects could be reported, leading to the withdrawal of the drug to protect the welfare of those on it as well as the general population. Furthermore, as vaccination advocates, a pharmacist's involvement in such outbreaks could lend support to immunization efforts and heighten the sense of awareness and importance for these population-based health initiatives. The pharmacist's profession and their efforts to target and counsel specific populations relative to specific

pharmaceutical regimens should include the efficacy modeling for preventive medicine and their feasibility in practice. Pharmacists are trained to help optimize drug regimens, provide patient monitoring, and foster prevention awareness through educational programs. Overall, this will help to maximize the person-to-person spread of diseases, optimize treatment effectiveness and disease prevention regimens, and forecast and model such results. Pharmacist intervention could potentially lead to reduced cases, reduced rates of hospitalizations and deaths, and reductions in economic disaster.

3.1. Medication Management and Adherence

Medication management and adherence are pivotal to effective treatment. Patients require the proper tools to understand their medications so that they can use them appropriately and safely. Pharmacists provide a means of communication from healthcare professionals to the patient. The methods of communication can provide different value to the treatment outcome. When working with a patient, their barriers or facilitators to stimulating a treatment recommendation need to be addressed. As part of the medication plan, social media is an important factor that can impact individual-level adherence and drive health services in a big data concept. An effective communication strategy between the pharmacist and the patient increases the likelihood that an individual patient will follow their treatment plan. Having an individual understand and be adherent to a treatment plan reduces the risk of cross-infection to society. This is particularly important in the event of health emergencies and can be applied to the overall end goal of epidemiological models.

There are many barriers to adhering to medication treatment plans. Socioeconomic factors, social determinants, transportation, health literacy, health confidence, and trust all impact the ability to follow a treatment plan. Multiple tools are used by pharmacists to tackle these social issues. Population-level tools utilized to address adherence include medication therapy management, medication synchronization, medication management, and health visits. It is also important for the pharmacist to have access to the right information in a timely fashion. In order to create realistic models, it is important to use realistic population behaviors and

data. Pharmacists work in areas where they collect data on population adherence patterns that can be applied to models. These real-world population data can help make models universally applicable to society. Pharmacist involvement in medication adherence is important because of the role it can play in prevention. Pharmacists can significantly impact how infectious diseases spread based on their involvement in vaccination.

4. Contribution of Laboratory Scientists

Laboratory scientists are central to the development and operation of epidemiological models. They provide essential diagnostic testing capabilities that underpin the ability to identify and monitor infectious diseases. Early, prompt, and accurate identification is critical to the initiation of public health responses. There is particular recourse at the start of outbreaks when other information may be difficult to collect in a timely manner. Laboratory data are thus important inputs to such models and further give a picture of disease over time. The data from these tests can inform different people in different places. For epidemiologists, using the tests can inform mathematical models to predict what is going to happen in an epidemic. The outcome can inform the logistical planning of when the epidemic is at its height. Laboratory scientists are also trained to contribute to public health efforts and surveillance, collecting credible data to help inform understanding.

Laboratory data provide a view of a disease similar to that which epidemiological models can have. The two thus complement each other. Laboratory data are used to determine the prevalence of disease, and that data, or the model outputs, are given to public health and other authorities and researchers to inform where vaccines and other interventions should be initiated. The two methods can thus be used to supplement the gaps in the information obtained. In this respect, the surveillance of disease incidence is one of the basic roles of laboratory systems and underpins their importance to epidemiological and other models. Epidemiological practitioners can therefore use laboratory surveillance systems to guide their practice, helping plan health services and guiding the treatment of an epidemic. Like other healthcare providers, laboratory scientists cannot work well in isolation. For many years, laboratory scientists have

participated in regular public health and health service planning meetings. What makes laboratory scientists special is that they can provide valuable sequencing of an organism that no one else can bring to the table, facilitating rapid response to health providers. A close working relationship has to be maintained with the epidemiologic and statistical modeling teams to better link laboratory surveillance data into mathematical models to provide a forecast in the spread of disease in the community and inform vaccination and other public health responses to an accelerating outbreak. We collaborate to suggest complementary strategies to control or reduce the incidence and spread of disease. The role of the diagnostic laboratory in the management of virtually all medical conditions is constantly being updated as new tests become available. Such changes at all levels of health interact with the microbiological changes in the community. Scientists working in the laboratory are directly involved in cutting-edge research into microbiology and emerging pathogens in a bid to continually innovate the role of laboratory science.

4.1. Diagnostic Testing and Surveillance

4.1. Diagnostic Testing and Surveillance Physical to Biological

The traditional role of laboratory scientists falls into two “camps.” They have a dual function as the roving diagnostician required to identify the infection that is causing detriment to the health of the patient at the point of care or send for off-site analysis, but also to survey populations or rearing stock or visiting some such location of interest to ensure disease incursion and incidence. The former can rapidly establish the cause of ill health in the patient with a direct effect on management or early intervention; treatments to target the infective agent, or have populations receive an early/mass intervention. Thus, both are involved in surveillance; monitoring incurrence, but also so-called prevalence to see and monitor how effective an ongoing intervention is to resolution (mortality if lethal to the infective agent, the case or drop in prevalence to less than one). Inclusion can be after the human or animal reaction to be monitored for, for appropriate sampling times.

Laboratory scientists undertaking these roles require tests that are accurate and reliable. Disease model

outputs rely on the validity and consistency of those data to test against. Poor diagnostic accuracy increases the individual variation in the data and leads to credibility issues with the model output. If an epidemiological physical model is not credible, why would interventionists use them? Not all of these data are used directly—but are also used to assess model dynamics—initially opposite effect when there is control but then overcomes the infective barrier, or the number of vaccinations before there is seen to be no prevalence effect or significant individual duration drop in individual infection data. Being dodgy with figures or producing sham or fake results can work for a while, but science has a set of physical laws, including that of error detection, and so is self-cleansing. Medical laboratory scientists are normally based in healthcare establishments. Diagnostic in-house laboratories within hospitals provide test results for inpatients, some outpatients, and members of the public who walk into the hospital. The range of tests undertaken can depend on the activities of the hospital. Large teaching hospital labs undertake a large range of tests and support extensive research activities and high-tech specialist centers’ activities. In other cases, diagnostics provided are restricted to a number of tests and often can involve specified groups of patients admitted to the hospital. (Lippi and Plebani2020)(McPherson & Pincus, 2021)(Igwe et al.2022)(Das et al., 2021)(Yu et al.2020)(Olatunji et al.2024)(Alrawahi et al.2020)(Binnicker, 2020)

5. Involvement of Nurses

Nurses are the largest healthcare providers dispensing most of the health education and care. They work in the community, hospitals, families, acute care facilities, and across the lifespan, giving them a unique position to decipher societal healthcare patterns. Public health is a key component of general healthcare. They are educators, which fits within their ethics. It is a nursing role to translate public health into a patient's personal healthcare. Nurses serve as the primary caretakers who have immediate access to patient needs. Nurses are on the frontlines in patient care facilities.

Nurses interpret and advocate for proper clinical and evidence-based care for their patients. The impact of nursing is vast within inpatient populations. As the largest healthcare provider occupation, they are best

positioned to implement governmental and professional practice guidelines in the day-to-day healthcare field. Public health awareness campaigns, community outreach in public forum conversations, vaccinations, and sponsored health screening activities for common diseases are often run or organized by nurses in local health fairs and hospitals. Nurses are public health educators. Public health is one of the seven values of nursing as part of nursing's mission to serve all communities. However, nurses face challenges because of a shortage of staffing in the hospital setting and because of mandatory staff ratios by governmental regulations. Their patients are sicker, requiring more intensive care and time, and have more comorbid conditions such as diabetes and obesity than in prior decades. Although there are great advantages to having various individuals in a healthcare team of polyclinics, military hospitals, or private practice, sometimes this can be a drawback. There are often varying aspects of care that may or may not fit into a "one size fits all" care protocol. Often, nurses will need particular instructions for care that fit within specific limitations in their particular facility. (Davis et al., 2021)(Godsey et al., 2020)(van der Cingel & Brouwer, 2021)(Ashley et al.2021)(Lasalvia et al.2021)

Dissemination, data collection, and charting are important for implementing a decision support system in healthcare. Nurses chart everything in the life of the patient, from their mood to their intake and output of fluids. When a patient is admitted, multiple systems are put into place to facilitate rapid diagnosis and treatment. Nurses have the details beyond a lab report. A certain amount of creatinine might signal kidney decompensation in one person, but in a person who historically has a certain amount and range, it may not indicate kidney injury. Beyond labs, the details provide an important factor; the patient might be exhibiting all of the other factors seen in other patients and nursing staff. It is a reference point for nurses to medical providers that basic norms are not always indicative. These situations highlight the importance of an amalgamation of nursing into epidemiological modeling and vice versa. Nurses are not just educators, but patient advocates. They know the patient. As a profession, they advocate and set priorities. They are almost counselors in this respect. For example, for a flu vaccine, the most effective

person in a hospital to give the recommendations or administer the flu vaccine would be a nurse. The nurse is said to be effective in answering questions about the vaccine. This supports the notion of adding an epidemiological model to involve nurses. Plus, they have a grasp on the real numbers of community vaccines for a targeted community. Additionally, the nurses would be the direct link as disseminators in acute situations as well as in community settings for the health department, especially in natural disasters. (Zhou et al., 2022)(Levi & Moss, 2022)(Aydin & Bulut, 2022)(Sandham et al.2022)(Cui et al.2020)(Jang et al.2022)(Kelley et al.2022)

5.1. Patient Care and Education

It is the responsibility of the nurse to ensure that patients develop a higher understanding of their health conditions, since improved health literacy can result from nurse-initiated initiatives and be an essential step when planning strategies beforehand. Concentrating on successful approaches to communication focuses on the learning prerequisites for nurses to be able to accurately convey their health needs and necessary actions. Nurses have multiple alternatives for device methods, considering the resources provided by the facilitation of organizations and the advancements of technology. The information given by nurses can lead to treatment adherence through health literacy strengthening, and this can also lead to improved prevention of diseases through health promotion.

Patients should not be educated without first evaluating their educational standards and personal resources. Health literacy differs considerably between individuals and between groups of various generations. By adapting patient education to meet such differing requirements, the nurse meets the unique specifications of the relevant patient groups. For a diverse group, achieving a common purpose is considerably more difficult. Nevertheless, cooperation between medical professional organizations usually results in favorable outcomes for the patients instead of between various practitioners in the health industry. Such applications enhance patient care by creating the correct environment and teaching new remedies before a patient arrives. As a consequence, computer and mobile applications are becoming a basic requirement under almost every improvement project and effectively complement contact with a

nurse and other amenities. (Nutbeam & Lloyd, 2021)(Patil et al.2021)(Nutbeam & Muscat, 2021)(Hudson and Montelpare2021)(Bin and Kamel2021)(Fitz-James & Cavalli, 2022)(Kickbusch et al.2021)

6. Role of Information Technologists

Information technologists play an important role in the development and maintenance of epidemiological models. We need to capture, store, and analyze health data in a way that makes this information useful. This means designing a robust data management system that makes it possible to gather information in ways that are effective, efficient, and meaningful. They help to plan and maintain disease surveillance systems that keep track of the epidemiology of a particular disease or condition in a population. As technology has advanced, so have our capabilities to use this technology to improve epidemiological models. Faster and cheaper computer systems, electronic medical records, new laboratory techniques, and improvements in statistics have helped us to develop more accurate and efficient models. We are better able to tailor analyses to our local context and can, therefore, be confident our results are relevant.

But there are still some challenges. If we can't share information and data between laboratories and health providers, for example, then our model might not be as accurate or as efficient as it could be. Our data should also be kept safe, secure, and available only to people who should see it. Without information technologists, our epidemiological models wouldn't have as big an impact. We need to focus on maintaining these relationships through effective knowledge translation. Through improving these relationships, we can continue to ensure a seamless integration of stakeholder data and more effective communication. Within the various stakeholders in public health, information technologists are the experts on the application and operation of their tools. The different areas where the expertise is provided include the full cycle of data and its associated analytics and knowledge from disease monitoring and regulatory assistance research. Also, in support of individuals' health, they can provide and implement health-monitoring devices and apps. Furthermore, physiologic data management and other data, like diagnostics and supportive devices, fall under health informatics

expertise. Computerized tools for personalized medical diagnostics and, more specifically, the use of bioinformatics to study the role of diabetes in pneumonia are within the expertise of information technologists. However, ongoing training and support for researchers, epidemiologists, and other disciplines that are leveraging these technological resources is necessary. As such, a gap in current skill sets of researchers and epidemiologists was identified in a survey. The use of health indicators, data management, statistical packages, surveillance tools, and the concepts and principles of health informatics were noted as areas for development. (Qosimov et al.2022)(Szymkowiak et al.2021)(Torakulovich2024)(Van den Broek et al., 2021)

6.1. Data Collection and Analysis

Information technologists carry out the data collection and analysis processes. The need for real-time information in epidemiological studies mainly relies on two methodologies: electronic health surveillance and data from administrative sources. The most significant feature of these two approaches is their ability to meet the data-processing requirements of public health decision-making. Technology has automated the task of carrying out the data collection and the analyses, allowing a vast increase in the amount of data that can be stored, searched, retrieved, and used. A crucial factor in the success of these activities is the standardization of data collection methods, allowing the creation of systems that can integrate the information from different sources and display the results in a harmonized way. A critical function of information technologists is to ensure that the data gathered are presented in a simple and effective way and are available at the disposal of anyone concerned.

The use of data is driven and constrained by the availability of appropriate technologies within the organization. Data analysts work closely with epidemiologists to interpret epidemiological statistics in terms of health objectives. At the European level, a challenge for moving towards efficient information and communication technology-driven epidemiology is the lack of clear governance of data for public health use as health systems and data protection laws diverge substantially. To advance these methodologies, an effective governance process that includes all

stakeholders is essential to govern data and ensure its appropriate use beyond medical practice. Data and these new analytic methodologies should ideally be developed and provided by the medical infologist in order to support data-driven medical decisions. (Benfeldt et al., 2020)(Micheli et al.2020)(Zhang et al., 2022)(Mäntymäki et al., 2022)(El Khatib et al., 2022)(Almagtome et al.2020)(Malodia et al.2021)

The Role of Healthcare Professionals in Dentistry within Epidemiological Physical Models

1. Dentists

Dentists are integral to the development and application of epidemiological physical models in oral health. They are responsible for diagnosing and treating oral conditions such as dental caries, periodontal diseases, and oral cancers. Dentists provide valuable data regarding the prevalence and distribution of oral diseases, which are essential for tracking disease trends and predicting future outcomes (Koh et al., 2020). In epidemiological models, dentists contribute by identifying risk factors such as age, diet, tobacco use, and genetic predisposition, and they help assess the impact of preventive measures like fluoride use and oral hygiene practices (Kaplan & Hays, 2022). By collecting data from routine patient exams, dentists inform models that predict the burden of oral diseases on public health, which is critical for developing effective prevention and management strategies (Buss et al., 2020).

2. Pharmacists

Pharmacists play a key role in managing medications for oral health conditions, such as antibiotics for infections and analgesics for post-treatment care (Lazarus et al., 2022). In the context of epidemiological physical models, pharmacists track medication use and adherence, providing insights into the effectiveness of treatments and their impact on oral health outcomes (Franke et al., 2021). They also monitor adverse effects, such as dry mouth or gingival enlargement, that can arise from medications, helping to inform the epidemiological models on drug-related oral health issues (Woessner et al., 2021). These contributions are essential for predicting the long-term effects of pharmaceutical interventions on oral health and for enhancing disease prevention strategies.

3. Laboratory

Scientists

Laboratory scientists in dentistry focus on the microbiological aspects of oral health. Their diagnostic tests help identify the pathogens responsible for conditions like cavities and periodontal disease, providing essential data for epidemiological models (Lippi & Plebani, 2020). Laboratory findings offer insight into the spread of oral pathogens, the impact of preventive treatments such as fluoride, and the effectiveness of disease management strategies (Mouratidis, 2021). By tracking the microbial composition of the oral cavity, laboratory scientists contribute to a better understanding of how oral infections influence broader public health issues, especially in relation to systemic diseases like diabetes and heart disease (McPherson & Pincus, 2021).

4. Physiotherapists

Physiotherapists contribute to the field of dentistry by supporting patients with musculoskeletal disorders of the jaw, neck, and face, which are often associated with dental treatments or conditions like temporomandibular joint (TMJ) dysfunction (Godsey et al., 2020). Physiotherapists help manage physical rehabilitation following dental procedures or surgeries, providing data on patient recovery and pain management (Levi & Moss, 2022). Their input into epidemiological models offers valuable information on the physical outcomes of dental treatments and helps inform models related to rehabilitation, particularly in terms of recovery times and the physical impact of dental procedures on overall health (Zhou et al., 2022).

5. Nurses

Nurses are vital to the prevention and education of oral health. They are often the first point of contact for patients and play an essential role in promoting good oral hygiene practices, such as regular brushing and flossing (Kelley et al., 2022). Nurses also help in screening for oral health issues and referring patients to dentists for further treatment (Sandham et al., 2022). In the context of epidemiological models, nurses contribute by providing data on patient adherence to oral hygiene routines, health literacy, and the effectiveness of public health campaigns aimed at preventing oral diseases (Cui et al., 2020). This data is crucial for understanding the spread of oral diseases and

evaluating the success of preventive measures across different populations.

6. Information Technologists
Information technologists support the field of dentistry by designing and maintaining systems for collecting and analyzing dental health data. These systems, such as electronic health records (EHRs) and dental health surveillance tools, allow for the efficient tracking of oral health conditions over time (Mäntymäki et al., 2022). Information technologists ensure that epidemiological models are informed by real-time data, improving the accuracy and relevance of predictions regarding the spread of oral diseases (Benham et al., 2021). They also address the challenges of data privacy and secure sharing of dental information, which are critical for collaborative public health efforts (Micheli et al., 2020).

7. Challenges and Future Directions
By and large, the challenges to the implementation of epidemiological models are related to data. The increasing demand for real-time access to health information, GIS/GPS, and other society-wide data at the individual level is difficult to achieve due to laws about privacy and other cultural or legislative inhibitions to data sharing. Further, one might argue that in practice the data, regardless of the virus, is not granular and is at best a proxy for phenomena of interest. Indeed, given the amount of bogus scientific studies that are published, there is concern that science is actually being used to prove political positions rather than statements of fact. Indeed, even under best-case scenarios with high-quality routinely collected and reported data and enthusiastically adopted standards of care, technology can create surprises, albeit embarrassing for researchers. In the case of SARS-CoV-2, the field was somewhat in the dark given that disease dynamics are a complex interaction of ecology, and ecology can be hard to predict, particularly with incomplete data and when the rules are unknown, which was the case here.
Needless to say, the stakes are high in terms of an effective public health response to identify immediately and isolate positive individuals; fewer people might die if the disease spreads more rapidly. If one believes every life is important, it becomes ignoble, if unethical, for specific individuals to politically argue about levels of risk without

thinking about how it will affect everyone. Some of the confounding factors are frequently cited, such as the fact that it is difficult to decide on what are and are not superspreader events prior to an outbreak. However, as technology and methodologies evolve, we can understand this issue more clearly. In the longer term, returning to the idea of model innovation, perhaps one of the most significant factors is truly exploring new relationships between multiple fields—and making a concerted effort to put all stakeholders at the same table. There are already multiple niches within which scientists and practitioners can commence exploration and contribution, such as modeling data science around viruses, infectious diseases, chronic diseases, and non-communicable diseases. By doing so, every niche has begun to address new challenges and fill the gap where the community needs it.

Conclusion

Epidemiological physical models are essential for understanding and managing the spread of oral diseases, which are closely linked to broader public health outcomes. The involvement of various healthcare professionals—including dentists, pharmacists, laboratory scientists, physiotherapists, nurses, and information technologists—strengthens the application of these models. Each professional contributes unique insights and expertise that help shape comprehensive strategies for disease prevention, treatment, and management. Dentists provide valuable data on oral disease prevalence, pharmacists ensure medication adherence, laboratory scientists contribute diagnostic data, physiotherapists assist in recovery, nurses promote oral health education, and information technologists manage the data necessary for accurate predictions.

While challenges like data privacy, real-time information sharing, and system integration persist, the collaborative efforts of these professionals are essential in improving oral health outcomes. By working together across disciplines, they enhance the accuracy and effectiveness of epidemiological models, ensuring that oral health is prioritized in public health strategies. As we continue to address global health challenges, the collective contributions of these professionals will be crucial in advancing the field of oral epidemiology and improving overall public health.

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