



Oncoming Revolution in the Next Generation of Cohort Studies

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Abstract

The world is changing rapidly, mainly due to the impact of megatrends that have an impact on the entire human life, particularly in medical sciences. Medical research methodologies such as cohort studies provide very critical information, but it is not clear what would be its destination in the future. In this short article, we have tried to offer a somewhat different perspective on the future of cohort studies by analyzing the texts and their conclusions from the author's viewpoint. According to our assessment, cohorts will play a key role in medical research, but their methodology will significantly change in terms of designing, implementing, analysing, and applying the findings. The new generation of cohort study extracts most of their information from electronic health records, and it is not just restricted to a particular geographic area. With the changes in the levels of occupational exposure, risk factors, and the introduction of Omics, likely, occupational and birth cohorts as well as human diseases will likely undergo fundamental changes in the future. Big data will provide researchers with new opportunities, but information extraction and analysis require a team of specialists from several scientific fields. Furthermore, participants are likely to play a more active role in setting priorities and implementing research findings.

Keywords: Cohort studies; Forecasting; Next generation

Introduction

The cohort study design, as an applicable method, is commonly employed in research, with its outcomes ranking second only to randomized controlled trials (1). Cohort investigations allow researchers to gain insights into the outcomes or natural progression of a disease or condition within a specific study population (2). This is because cohort studies offer high external validity and can more accurately depict the impacts of interventions (3). Furthermore, they do not face

certain limitations present in interventional studies, such as ethical considerations, high costs, and constraints on the size or duration of follow-up (4, 5). Therefore, it is expected that despite changes in various domains such as megatrends, digitization of services, changes in the process of collecting information, and even the way participants participate in studies, cohort studies will continue to be of interest by adapting to the changes.



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The world is changing rapidly, mainly due to the impact of megatrends and the field of health and diseases is not exempt from these changes. Although; there is no consensus on the definition of megatrends, it can be distinct as long-term structural changes that have irreversible and deep consequences on the world. Megatrends, such as globalization, digitization (6), data sharing, and population aging (By 2030, 1 in 6 people in the world will be aged 60 years or over) and their complications and effects will impact the entire human life, particularly on medical sciences (7).

Digital health technologies have the potential to revolutionize cohort studies in the future. By leveraging wearable devices, mobile apps, and remote monitoring tools, researchers can collect real-time data on participants' health and behaviors in their natural environments (8). Additionally, digital health platforms can facilitate the recruitment and engagement of diverse, representative cohorts, overcoming traditional barriers to participation (9). As digital health becomes more integrated into healthcare systems, the ability to link these data streams with electronic health records will further strengthen the power of cohort studies to uncover novel discoveries and drive personalized medicine.

Medical research methodology has changed rapidly in recent decades. In this context, cohort studies provide very critical information, but it is not clear what would be its destination in the future. Is it still necessary to follow a cohort, given that comprehensive data banks such as medical records and electronic health records are being formed and evolved, or will digitization demolish cohort studies? So far, the future of these studies has not been investigated and studied, so in this short article, we have tried to have a relatively different look at the future of cohort studies by reviewing the texts from the perspective of the author.

Discussion

Undoubtedly, the new generation of cohort studies (NGCs) differ in every aspect. Due to the impact

of globalization, digitalization, and concepts of personal/precise/lifetime medicine, and knowledge utilization, the application of conventional cohorts would be limited. Respecting these changes, it seems that NGCs are following very large or even multinational studies that measure precise variables and link their data with electronic databases. The subsequent section will discuss the main aspects of future cohort studies.

Study design

NGCs extract most of their information from electronic health records, not limited to a small geographic area with new ethical considerations. Without any doubt, most of the conventional variables will be stored in the e-health records (9), which means NGCs will collect historical and prospective information automatically from these databases with minimum costs. Worldwide studies, also known as global studies, is an interdisciplinary field that focuses on the transnational processes and phenomena that shape our interconnected world (10). Sharing big databases containing detailed clinically relevant information from different countries will enable us to design and implement multi-national cohorts. Ethical considerations: With the digitization of people's information, maintaining data security and information confidentiality is one of the important points of privacy protection. Ensuring the security of data and how to access them is disputed. There is always the possibility of remote health platforms being hacked (11), surgical robots, robotic nurses, and the possibility of selling data to insurance companies (12, 13). The concepts of privacy, informed consent, and direct and indirect use of personal information will give different definitions in NGCs. Therefore, it may generate new ethical considerations. Therefore, the design of cohort studies in the future will be affected by the mentioned.

Target group identification

With the changes in the levels of occupational exposure and the introduction of Omics, it is

likely that occupational and birth cohorts will undergo fundamental changes in the future. Since 1883, occupational exposure limits have been established, making the industry safer and reducing risk factors and additional risks. Therefore, workplaces will be different safer, and more stable places in the future (14). Working from a distance, even at home, will be much more common. Robots are being replaced in laborious jobs and working in hazardous locations. As occupational exposures decline, occupational cohorts will become more similar to population-based cohorts and will likely play a smaller role in studies.

On the other hand, future life will only be understood by studying how pregnant women, infants, and children live. To understand the mechanism of causal factors affecting disease, health, and longevity, data must be accurately and thoroughly measured, which will be accomplished with the help of Omics concepts and DNA collection for metabolomic and proteomic studies (15). In addition, considering that accurate and comprehensive data banks are being shaped, People's information can be obtained even before birth (16). Therefore, birth cohorts will likely to play a greater role in identifying factors influencing health and will be more important than occupational studies.

Exposure and Outcome

Future human diseases will most likely differ from current diseases due to changes in the risk factors.

Some risk factors are universal and exist throughout the world, and we are confronted with new categories of health threats. Human population, economic activity, ocean acidification, and greenhouse gas emissions have all increased (17). Therefore, such rapid and fundamental disruption may send the earth on unexpected, unprecedented, and irreversible paths, endangering human health. These common risk factors would almost certainly lead to changes in exposures and diseases in the future, emphasizing the importance of conducting global cohorts.

Lifestyle changes, the ease of international migration, and revolutionary advances in information technology will lead to a decrease in social interactions and physical activities in the coming decades (18). Furthermore, the occurrence of multimorbidity, defined as the coexistence of two or more concurrent chronic conditions (e.g., diseases, risk factors, or symptoms) in one patient, is increasing (19). Therefore, risk factors will change and become more complex. In addition, the diseases of human society in the future will most likely differ from those of today due to changes in risk factors. In addition, because of changes in physical and social environments or lifestyles, Emerging diseases will appear. Thus, in the future, cohort studies will serve as an appropriate methodology for investigating the influence of global risk factors on complex and emerging illnesses.

Data analysis

Although big data will open up new opportunities for researchers, it will also present new challenges. The digitization of healthcare data, including electronic medical records such as patient medical records, physician notes, clinical reports, biometric data, and other health-related medical data, is producing big data that provides comprehensive and complete information but cannot be managed using traditional techniques, necessitating a new processing style (20). However, the development of reliable techniques for identifying and controlling sources of error will be critical for effective database mining. Because big data will be combined with data mining concepts, current methods will be incapable of handling such analysis. Statistical methods are likely to evolve. On the one hand, the analyses become harder and more complex. As a result, conducting analysis will become highly specialized, resulting in changes in conceptual understanding and interpretation.

Participation in research

The level of literacy of community members influences their participation in research. The

literacy level of society has increased in recent decades (21), and society's perception of research and participation in research will most likely change. Furthermore, communities are likely to play a more active role in research, from setting priorities to implementing research findings.

Risk of bias assessment

Quality assessment tools are useful in the reporting of research (22). These tools have evolved to improve studies reporting. Based on the structure of NGCs, which will change according to new exposures and diseases, new quality assessment tools will probably be designed.

Conclusion

Future cohorts would see changes in a variety of concepts. The diseases and risk factors that humanity will face in the future will be complicated. The human effort to discover the underlying causes of diseases linked to genetics and the environment will lead to Omics that may not be measurable using current simple methods. Furthermore, with the advent of Omics and as industries become safer, birth cohorts are likely to become more important. As a result, it appears that more training for researchers in the field of omics in research is required. Furthermore, more emphasis should be placed on developing an appropriate foundation for designing prenatal studies. Although digitizing information sources enables global cohorts, managing these data will be difficult and time-consuming, and current methods are incapable of handling such analyses. As a result, in order to manage these databases, it is necessary to provide the infrastructure required to achieve artificial intelligence and machine learning technologies in the first stage, followed by specialized training in this field in the second stage.

Conflict of Interest

The authors declare that there is no conflict of interests.

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