

Editorial

**Trajectory Modelling: A Novel Approach to Dig Value of Longitudinal Cohort Studies**Siyan Zhan^{1,2,3,#}

Cohort studies are important epidemiological methods to investigate associations between environmental factors, individual characteristics, and disease or other health outcomes. As a paradigm of cohort studies, the Framingham Heart Study (FHS) is the longest-running cardiovascular epidemiological study, starting in 1948. Over 70 years, FHS not only firstly proposed the concept of risk factor in 1961, but also successively reported the roles of various risk factors such as age, blood pressure, cholesterol, smoking, and obesity, developed clinical diagnostic criteria for heart failure, promoted the clinical development of atrial fibrillation antiarrhythmic and anticoagulant therapy, established a 10-year and lifelong risk prediction scoring tool for coronary heart disease, and the research content has extended to multiple disease fields^[1]. A number of longitudinal cohort studies have also been established in China since 1970s. Especially, the China Kadoorie Biobank (CKB) with 510,000 participants, as the largest scale cohort in China, was established in 2004. The high-quality scientific researches have been conducted consecutively based on the CKB cohort data, the researches of the relationship between healthy lifestyle and major chronic diseases have provided specific evidence in Chinese population^[2]. In order to share multi-cohort data, the China Cohort Consortium (CCC) was initiated in October 2017^[3] and the general and variable information of 159 cohorts, including natural population cohorts, birth cohorts, occupational and disease-specific cohorts, have been displayed in CCC website (<https://cohortconsortium.com/>).

Traditional cohort studies typically only focus on the relationship between baseline exposure and outcomes^[4,5]. In this issue, Shuanghua Xie et al. reported a prospective birth cohort study to investigate the association between ABO blood types and gestational diabetes mellitus (GDM) risk^[6]. As an

inherent characteristic of individuals, ABO blood types are not varied with time. The GDM occurrence was defined yes or no in this study. Thus, this fix cohort is similar with cross-sectional study. The investigators do not need to consider the dynamic changes in exposure factors and disease progress. So logistic regression was applied to calculate the Odds Ratios (ORs) and 95% Confidence Intervals (CIs) between ABO blood types and GDM risk. With the development of longitudinal cohorts, Individual-level longitudinal data on biological, behavioural and social dimensions are becoming increasingly available. In many studies, measured health outcomes are averaged out and their evolution across the entire study sample or pre-specified observed subgroups is analyzed. However, in most cases, unknown or unexpected subgroups of individuals share similar patterns of clinical symptoms, behaviours, or healthcare utilization. Thus, describing populations of individuals using averaged estimates amounts to oversimplifying the complex intra- and inter-individual variability of the real-life clinical context. Therefore, trajectory modelling approaches have been developed to address this challenge.

A trajectory describes the course of a measured variable over age or time. Individuals can be assigned to homogeneous subgroups (distinct trajectories) that are interpreted as representing similarities on given outcomes. In healthcare research, trajectory approach is helpful for improving our understanding of disease severity, interference, management, and evolution over time. For example, Song M et al used a trajectory approach to identify distinct subgroups of participants with similar evolution of body shape over the life course in two large cohort studies and found that heavy body shape from age 5 up to 50, especially the increase in middle life, was associated with higher mortality^[7].

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Investigators in epidemiology and other fields are often interested not only in the trajectory of variables over time, but also in how covariates may affect their shape. Traditionally, hierarchical modeling and latent curve analysis have been used to measure these relationships, but in recent years, a group-based approach known as group-based trajectory modeling (GBTM) has increased in popularity as an alternative. Whereas hierarchical modeling and latent curve analysis estimate the population average trajectory and use covariates to explain variability about this average, group-based trajectory modeling assumes that the population is composed of distinct groups, each with a different underlying trajectory.

In this issue, novel GBTM was used by two cohort studies to identify frailty trajectories^[8] and FBG trajectories^[9], respectively. Yang Liu et al. explored the relationship between Solid Cooking Fuel Use and Frailty Trajectories and concluded that Solid cooking fuel use is associated with frailty trajectories in middle-aged and older Chinese populations^[8]. Mingxia Zou et al. investigated the patterns of fasting blood glucose (FBG) trajectories and analyzed the relationship between various occupational hazardous factors and FBG trajectories in male steelworkers. They found that with an increase in ERS, the risk of FBG trajectory levels also increases^[9].

In summary, it is crucial to pay attention to trajectory approach in longitudinal cohort studies, as it can reveal the dynamic changes in exposure factors, disease development, or health outcomes, rather than just static “starting points” and “endpoints”.

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