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Mini Review

Application of Group-Based Trajectory Modelling (GBTM) to Assess Supportive Care Needs (SCNs) in Oncology Patients

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Abstract

Group-Based Trajectory Modelling (GBTM) is a semi-parametric mixture model employed to identify clusters of individuals within a population, based on latent subgroups that exhibit similar longitudinal trajectories of a single outcome. The specifications for the analytical model necessitated a configuration comprising three groups, a linear polynomial order, and the application of standardization as the normalization technique. This article endeavours to review the utilization of group-based trajectory modelling to investigate the trajectories of Supportive Care Needs (SCNs) among cancer survivors. Furthermore, it seeks to identify the associated influencing factors and evaluate drug adherence in cancer patients.

Keywords: Medication adherence, Cancer survivors, Supporting care needs, GBTM

Introduction

GBMT for SCNs in Cancer Survivor

Cancer has become a major global public health issue, representing a considerable threat to human health and well-being. According to recent data from the International Agency for Research on Cancer (IARC), there were nearly 20 million new cancer cases in 2022, with demographic projections suggesting that this figure will surpass 35 million by 2050. Although historical global data have consistently shown high cancer mortality rates, recent evidence indicates a decline in mortality, which can be attributed to advancements in medical technology and changes in lifestyle patterns [1-4]. With advancements in survival rates, the emphasis of care for cancer survivors has increasingly shifted from solely extending life to enhancing quality of life and mitigating discomfort. Following

the completion of primary treatments, cancer survivors continue to endure a variety of physical symptoms, such as pain, fatigue, and nausea, alongside psychological symptoms, including anxiety, depression, and irritability. These symptoms originate from both the treatment modalities and the disease itself. Research suggests that cancer survivors may simultaneously experience six to nine physical and mental symptoms, leading to a significant burden of disease management due to the persistence and interaction of these symptoms. Consequently, addressing these multifaceted issues has become a critical focus in contemporary cancer survivorship care [5-13].

Although there is significant potential to enhance management and quality of life, the systematic development of comprehensive programs to support healthcare professionals in managing cancer survivors remains limited. To address this gap and facilitate the creation of effective service systems that mitigate the impact of cancer on the lives of surviving patients, Fitch et al. proposed a supportive care framework. They defined Supportive Care Needs (SCNs) as the multidimensional assistance required to address complications and side effects throughout the entire disease trajectory [14]. Recent studies have comprehensively investigated the Supportive Care Needs (SCNs) of cancer survivors. There is increasing evidence indicating that survivorship care programs specifically tailored to address these needs can improve resource utilization and significantly alleviate the care burden experienced by cancer survivors [15-16].

Studies predominantly examine Supportive Care Needs (SCNs) at a single temporal point, concentrating on the determinants of these needs to enhance patients' quality of life. However, supportive care theory suggests that patients' SCNs are subject to dynamic changes, with varying emphases at different stages of disease progression. In accordance with this theoretical framework, a growing number of researchers have shifted their focus to longitudinal studies of SCNs, employing diverse statistical methodologies to identify patterns of change. Traditional methods, such as repeated measures analysis of variance, hierarchical modelling, and Latent Growth Curve Modelling (LGCM), assume population homogeneity, a condition that is often challenging to achieve in practice. Nonetheless, recent advancements in statistical methodologies have enabled the development of innovative approaches for analyzing longitudinal data [17-21]. Group-based trajectory modelling represents a relatively novel methodological approach that addresses the limitations inherent in traditional statistical techniques. Unlike conventional methods, these approaches operate under the fundamental assumption of population heterogeneity, thereby facilitating the identification of distinct subgroups characterized by similar trajectory patterns. The advent of these methods has undoubtedly provided an effective tool for analyzing differences in individual developmental trends and gaining deeper insights into the unique growth characteristics of various subgroups. Furthermore, the group-based trajectory modelling approach can more flexibly accommodate nonlinear and complex trajectory fitting than traditional methods, allowing each latent class to possess an independent trajectory form, whereas traditional methods necessitate a pre-specified fixed functional form (e.g., linear, quadratic). Notably, the group-based trajectory modelling approach can visualize subgroup trajectory maps instead of relying on abstract parameters to express trends, as is common in traditional approaches. The application of group-based trajectory modelling in medical research has gained significant traction, with an increasing number of studies employing this methodology to investigate SCNs trajectories among cancer survivors [22-26].

Variations in the trends of Supportive Care Needs (SCNs) among cancer survivors can be attributed to differences in study design, including statistical methods and follow-up duration, as well as the heterogeneity of populations arising from diverse demographic, sociological, and disease-specific backgrounds, such as cancer type and stage. Notably, there is a significant gap in research that comprehensively synthesizes both the trajectories of SCNs and their influencing factors among cancer survivors. Furthermore, the expanding body of evidence highlights substantial cross-cultural and regional variations in SCNs, particularly in sexuality needs, which tend to be a more private subject for Asian populations, potentially leading to findings that underestimate the actual situation. As China, the world's most populous nation, comprises approximately 20% of the global cancer survivor population, it is imperative to focus on the SCNs of Chinese cancer survivors. The lag in clinical practice and individualized care, coupled with a lack of comprehensive understanding of the evolving trends in the SCNs of Chinese cancer survivors, may result in clinical neglect of critical needs of specific groups at particular stages or even lead to a misallocation of care resources [27-29].

The Use of Group-Based Trajectory Modelling (GBTM) Facilitated the Identification of Medication Adherence Trajectories

In France, 106 Systemic Oral Anti-Cancer Therapies (SACTs) are currently available through the national health service, with 39% categorized as targeted therapies. While oral SACTs offer distinct advantages for patients, they also present various drawbacks and therapeutic challenges. A primary benefit of oral SACTs is the simplification of the treatment pathway, which provides patients with increased autonomy and enhances quality of life, in contrast to conventional chemotherapy or immunotherapy that typically require injectable administration and, consequently, day hospital care. Patients assume a central role in their treatment, gaining greater control and responsibility over their care, which can foster empowerment, enhance engagement, and improve adherence. This autonomy enables patients to actively participate in decision-making and tailor their management to their personal circumstances, ultimately contributing to improved treatment outcomes [30-35].

Nevertheless, the increased responsibility associated with oral

SACTs presents challenges in treatment management. Optimal adherence to these therapies may be impeded by various factors, including cognitive impairment, swallowing difficulties, and complex medication regimens. These barriers are frequently linked to advanced age or comorbidities, which are prevalent in oncology populations. Furthermore, polypharmacy heightens the risk of drug-drug interactions, including those involving Complementary and Alternative Medicines (CAM), potentially resulting in diminished treatment efficacy or heightened toxicity. In outpatient settings, where patients are tasked with managing their treatment, these factors underscore the necessity for a dynamic and multifactorial approach to understanding adherence behaviours. Although oral SACTs impose greater responsibility on patients to meticulously follow oncologist-prescribed regimens, high rates of non-adherence have been documented during long-term treatment [36-39].

Medication adherence is a critical component of cancer treatment, yet adherence rates among cancer patients vary significantly, with some anti-cancer therapies exhibiting adherence rates as low as 14%. Consequently, patients may face reduced survival rates, disease progression, an increased risk of hospitalization, heightened demand on healthcare resources, diminished functional capacity, and a lower quality of life. The phenomenon of medication adherence is complex and is influenced by a multitude of factors, including the nature of the disease, treatment regimens, individual patient characteristics, environmental factors, and healthcare systems [40-48].

Tools for evaluation of Medication Adherence

The Girerd Adherence Scale is a six-item, self-administered questionnaire designed to assess medication adherence. Initially developed for patients with hypertension, this instrument has demonstrated reliability across a diverse range of medication adherence studies. A score of 0 indicates good medication adherence, a score of 1 or 2 suggests minor non-adherence, and a score of 3 or higher signifies non-adherence [49-53]. Therapeutic Drug Monitoring (TDM) serves as another valuable tool in assessing the pharmacokinetic steady state, which is a standard of care for evaluating drug adherence in cancer patients.

Conclusion

Studies have shown the trajectories of SCNs among cancer survivors exhibit significant heterogeneity. While individual and disease-level factors are frequently documented, there is a notable lack of evidence regarding the impact of social support, healthcare system factors, and community-level determinants. Future research should incorporate broader socio-environmental determinants to enhance the understanding of SCNs patterns and inform the development of tailored survivorship care. Few studies have demonstrated that Group-Based Trajectory Modelling (GBTM) identified three distinct and clinically significant patterns of oral Systemic Anticancer Therapy (SACT) adherence trajectories among outpatients monitored during day hospitalization. Understanding the factors influencing these trajectories offers a dynamic perspective on the complex phenomenon of medication adherence and underscores actionable factors to support tailored health interventions.

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Competing Interest

The authors declare no competing interests.

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