Evaluating Public Health Interventions through Interrupted Time Series Analysis: A Comprehensive Tutorial

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Abstract

Interrupted Time Series (ITS) analysis is an essential method for evaluating the effectiveness of public health interventions, highlighting its application, methodological considerations, and statistical analysis techniques through a practical example.

Introduction

Interrupted Time Series (ITS) analysis is a robust alternative for evaluating public health interventions when randomized controlled trials are not feasible, offering a detailed guide on its application and methodology. (Content generated using PlusMind ChatGPT. Editable on www.plusmind.ai)

Data

The dataset from Barone-Adesi et al.'s study examines the effect of Italy's 2005 smoking ban on hospital admissions for acute coronary events in Sicily between 2002 and 2006 for those aged 0-69, serving as an example to illustrate ITS analysis methods.

Interrupted Time-Series Design

1. Appropriateness: Assess if ITS is suitable based on intervention type, outcome interest, and data availability. 2. Impact Model: Hypothesize expected intervention impact on the outcome, considering immediate or gradual changes. 3. Descriptive Analysis: Analyze data for trends, seasonal patterns, and outliers to understand the intervention's effect. 4. Regression Analysis: Perform segmented regression to analyze the intervention's impact on the outcome. 5. Methodological Issues: Address issues like seasonality, autocorrelation, and confounders to ensure analysis robustness. 6. Model-Checking and Sensitivity Analyses: Validate the model's robustness through residual checks and sensitivity analyses.

Discussion/Findings

Interrupted Time Series (ITS) analyses can be used in evaluating interventions without randomization, highlighting their real-world applicability and cautioning against potential validity threats, while underscoring the necessity of methodological rigor for credible evidence.

Mothodological Issues

1. Seasonality: Implements strategies to mitigate seasonal effects in data, ensuring results aren't skewed by predictable fluctuations. 2. Time-varying Confounders: Controls for variables that change over time and could influence outcomes independently of the intervention. 3. Use of Controls and Other More Complex ITS Designs: Enhances analysis robustness by incorporating control groups or outcomes and employing more sophisticated ITS designs. 4. Over-dispersion: Adjusts for cases where data variance exceeds the mean, crucial for accurate standard error estimation. 5. Autocorrelation: Corrects for the non-independence of observations in time series, ensuring model residuals are independent.