Beckham Carver

Jan 28, 2022

STAT 4025

Prof. Robinson

Homework Assignment 2

1. Fine particulate matter is an air pollutant that triggers inflammation and airway   
   constriction in experimental models. A study evaluates the association of fine particulate   
   matter with asthma in children. Researchers recruit 1,300 children, ages 4-8 years old,   
   from pediatric clinics in three large metropolitan areas. Study children are free of asthma   
   and reactive airway disease at the start of the study. Fine particulate matter data is   
   collected from monitors located near each child's residence and new occurrences of   
   asthma are assessed via annual examinations. The researchers categorize the amount of   
   fine particulate matter as low versus high using a cut point of 15 ug/m3. Results are   
   shown below.   
      
   Table

   Description automatically generated  
      
   In the class notes, I went over 5 different criteria for establishing causality. Go through each of   
   these criteria and justify why each is met/not met. [10 pts]

Answer: The study does not involve administering any experimental factors onto patients and merely observes the selected patients; therefore, it is an observational study. Also, because they are sure to first select children who do not have asthma and then follow up through the years, it is an observational cohort study. By design as an observational cohort study**, it fails the first criterion for establishing causality** because no randomness can be implemented through an observational study.

The second criteria are whether a strong association is found, measured using relative risk. The prevalence in percent for those exposed to low levels of fine particulate matter 25% (200/800) and for high exposure the prevalence is 50% (100/200). Using these values, the relative risk is calculated to be 25% / 50% = 0.50. This value is less than 0.67 which means it **passes the second criterion for establishing causality.**

It is established through previous scientific studies that fine particulate matter exposure is related to asthma and similar diseases, children whose mothers when pregnant were exposed fine particulate matter are more likely to develop asthma. \* There is a scientific precedence and basis for this conclusion, so the study **passes the third criterion for establishing causality. (**<https://www.sciencedirect.com/science/article/pii/S0091674919304798>**)**

The data provided from this study is not sufficient to establish a clear dose-response relationship. The children in the study were split directly into two groups, with only two points of reference we cannot conclude there is a dose response relationship. With additional data- specifically regarding the exact levels of fine particulate matter- we may be able to establish a dose-response relationship. However, without that data this study **fails the fourth criterion for establishing causality.**

As a observational cohort study (refer to paragraph one) this study shows a temporal relationship by design. Because children are selected without the experimental condition, and then observed over time until they do or do not exhibit the disease, we can establish a temporal relationship. The study **passes the fifth criterion for establishing causality.**

With confidence we can establish causality regarding fine particulate matter causing increased rates of asthma, because three of the five criteria to do so were met.