What were the costs of this paper? The Wakefield paper linking the MMR vaccine to autism has been estimated to have led to a significant drop in MMR vaccine uptake in England, the U.S., and parts of Europe resulting in a large measles outbreak that caused hospitalizations and deaths. The economic costs are estimated to be in the billions of dollars. Additionally, the paper eroded public trust in vaccines and the scientific community, contributing to ongoing vaccine hesitancy and misinformation.

Could this have been avoided? The study had several significant statistical problems. The issues present in the Wakefield study were not overly complex; rather, they were concerns that a proficient statistics student could have potentially identified and questioned. These included:

1. Small sample size: The study included only 12 children.
2. Selection bias: The individuals involved in the study were not chosen at random, suggesting that they might not accurately reflect the broader population of children who were administered the MMR vaccine.
3. Lack of a control group: The study lacked a control group composed of unvaccinated children, complicating the task of contrasting autism prevalence between those who received the MMR vaccine and those who did not.
4. Confounding factors: The study did not adequately account for other factors that could be associated with both MMR vaccination and autism, such as family history of autism, which could have influenced the study's results.
5. Poor statistical analysis: The statistical analysis in the study was flawed, with inappropriate methods used to analyze the data, and selective reporting of results.

The Wakefield study and its consequences demonstrate the importance of a statistically literate society.

1.4 Exercises

Basic Concepts

1. What does it mean to be statistically literate?

2. The Wakefield MMR vaccine controversy is often cited as an example of the consequences of insufficient statistical literacy. What were the statistical problems present in the Wakefield study, and how could these have been avoided?

3. What does it mean to have an intuitive understanding of statistics? How would you develop an intuitive understanding of statistics?

4. When presented with a statistical conclusion, what types of questions should a statistically literate person ask?

1.5 Statistics and Related Fields as a Career

Note

Check out the video entitled *Statisticians in Other Fields* on the *This is Statistics* YouTube channel.

Your career will essentially be a choice of the kinds of problems you desire to solve. Because the amount of data being stored in the world is doubling every two years, we