

STATISTICAL

SIGNIFICANCE

Efficiency, Efficiency, Efficiency: Statisticians have developed powerful analysis tools that allow one to extract robust conclusions from data samples. As a result, industry, agriculture, pharmaceutical companies have improved their productivity and competitiveness immensely.

Economic Productivity

SEARCH ENGINE ADVERTISEMENT PRICING:

Auction theory is used to help monetize search-based advertising. Ads are ordered according to their expected revenue to the search engine and if an ad is clicked, that advertiser pays the bid of the advertiser whose ad is immediately below.

MONITORING OUR ECONOMIC HEALTH:

Statistical methods are used extensively to determine the myriad measures of our economy, from the trade deficit and gross national product to the consumer price index (CPI) and the unemployment rate. Accurate measurements of these quantities are essential to keeping our economy healthy and competitive.

MINIMIZING WASTE:

Guinness Brewing Company hired William Gossett in 1899 for his chemistry training but Gossett made his greatest contribution by developing a statistical technique to better estimate the amount of yeast in a solution based on a small sample. With the new information, Guinness was able produce its now-famous products efficiently.



SOFTWARE/ WEB DEVELOPMENT:

Microsoft has developed sophisticated software to run controlled “live” experiments to objectively evaluate software features. Users are randomly assigned into control and treatment groups and then their behavior analyzed using various statistical methods. The results are quickly adapted to integrate or discard the feature, thereby accelerating and improving software and web development.



Quality Assurance in Manufacturing

W. E. Deming pioneered statistical methods to help manufacturers evaluate the overall quality of their product by sampling only some of the units. An important component of Total Quality Management (TQM), statistical process control prescribes the monitoring of the specifications of the product through out the process to maintain and improve its quality. Companies that followed Deming’s advice and the work of his counterparts thrived in an increasingly globally competitive market.

INVENTORY CONTROL AND STAFFING:

Companies use sophisticated methods developed by statisticians to manage their inventories to ensure products and supplies are always on hand while minimizing storage costs and over-purchasing. Similarly transfer functions and advanced statistical software are used to estimate staffing for call centers to minimize wait-time and dead-weight (staff idle time) cost.

“Statistics Powers Competitiveness” is part of *Statistical Significance*, a series from the American Statistical Association documenting the contributions of statistics to our country and society. For more in this series, visit www.amstat.org/xxx. The American Statistical Society is the foremost professional society of statisticians, representing 18,000 scientists in industry, government and academia: www.amstat.org.

STATISTICAL SIGNIFICANCE

Statisticians have developed powerful tools to extract summary information from data. In healthcare, the result is vaccines and treatments that reach the public more quickly and with more accurate assessments of both benefits and side effects.

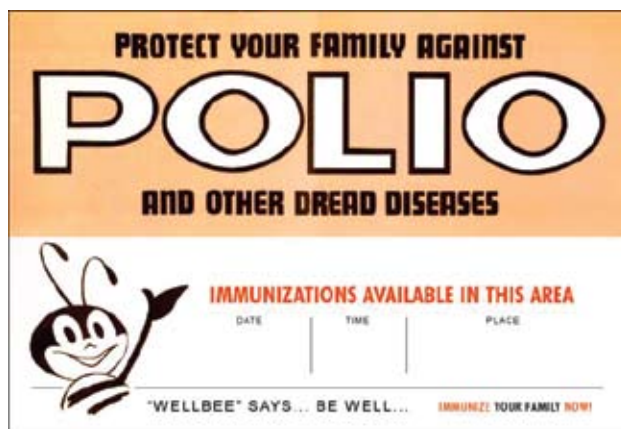
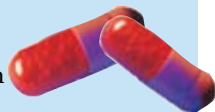
Health Care Research

TRACKING THE NATION'S HEALTH:

Statistical methods are used extensively to monitor various aspects of U.S. health, from the health status of the population and subgroups and the monitoring of trends, to the use of health care by various population characteristics and the identification of emerging health problems. Accurate measurements are essential to keeping our population healthy, evaluating the impact of health policies and programs, and informing changes in public policies and programs.

MODERN DRUG DESIGN:

Uncertainty concerning clinical trial design remains despite carefully planned early phases of a drug development program. Statisticians, all the way back to the Reverend Thomas Bayes, have contributed to adaptive trial designs. Adaptive clinical trial designs make trials more efficient and ethical by assigning patients to treatments in a way that maximizes learning about the treatments' efficacy and the outcomes for patients in the trial.



1963 polio vaccination card

Polio Vaccine

Before a vaccine was developed, polio afflicted millions of people worldwide and took the lives of more than 1 in 10. Scientists used double-blind randomized controlled experiments to show that the vaccine developed by Jonas Salk was effective and safe. By assigning treatment and placebo randomly and by keeping the patient and evaluators from knowing the assignment, statisticians removed as much bias as possible from the estimates of the vaccine's efficacy, thereby ensuring more accurate conclusions.

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Statisticians working in agriculture provide data to the producer and the public relative to the food supply. New statistical methods are developed and used to help keep food costs down, increase production, and estimate seasonal commodities.

Agricultural Production

“I know of no pursuit in which more real and important services can be rendered to any country than by improving its agriculture, its breed of useful animals, and other branches of a husbandman’s cares.”

—George Washington

FACTORS AFFECTING A FIELD’S OUTPUT:

How does one untangle the vast number of variables that affect a field’s crop production? R. A. Fisher made the first contributions in the early 20th century performing a statistical analysis of the time series to disentangle some of the factors affecting wheat crops, including a long term decrease due nutrient depletion and shorter-term factors having to do with climate.

HASTENING THE “GREEN REVOLUTION”

Statistical testing and analysis methods were key to verifying the high-yields of new strains of wheat and rice crops, allowing them to be rapidly cultivated around the world.



KEEPING FOOD

AFFORDABLE: Statistics has played a pivotal role in the huge advances in crop production which have helped keep food prices low and helped reduce food shortages world wide.



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