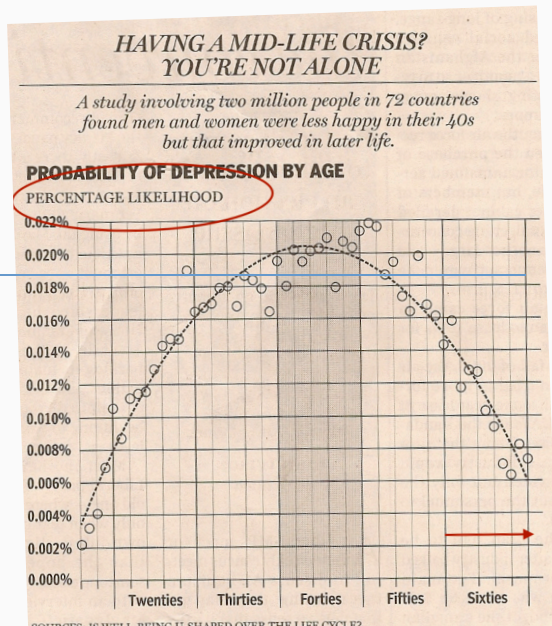


Mathematical Statistics II

STA2212H S LEC0101

Week 12

April 1 2025



- April 3 11.00 –12.00 Hydro Room 9014
“Efficient sampling by algorithmic diffusion”
- April 10 11.00 – 12.00 Hydro Room 9014
“Towards a mathematical theory of development”
- April 17 11.00 – 12.00 Hydro Room 9014
“Stage-aware learning for dynamic treatments”
- April 25 9.45 – 5.05 Hydro Room 9014
Statistics Graduate Student Research Day 2025

- **Likelihood inference:** maximum likelihood estimates, consistency, asymptotic normality, delta-method, optimization (N-R, E-M, Q-N), Kullback-Leibler divergence, likelihood ratio statistics, profile likelihood function, nonparametric MLE, empirical cdf, significance functions, approximate pivotals, misspecified models, sandwich estimate of variance
Jan 7, 14, 21
- **Bayesian inference:** prior distribution, posterior distribution, conjugate priors, flat priors, Jeffreys' invariant prior, multi-parameter problems, marginal posteriors, interpretation of prior and posterior distributions, hierarchical Bayes
Jan 21, 28, Feb 4
- **Optimality in estimation:** asymptotic efficiency, Cramer-Rao lower bound, finite-sample optimality, regular estimators, efficiency, asymptotic relative efficiency, decision theory, loss functions, risk functions, Bayes risk, admissibility, minimax, Bayesian hierarchical models, shrinkage estimation, Bayes and Fisher
Feb 4, 11

... Summary

- **Interval estimation:** exact confidence intervals, approximate confidence intervals, pivotal quantities, exact and approximate confidence regions, Bayesian credible intervals, approximate normality of posterior, highest posterior density intervals, profile likelihood intervals, nonparametric confidence bands – pointwise and simultaneous, bootstrap confidence Feb 11
- **Hypothesis testing:** null and alternative, test function/statistic, rejection/critical region, type 1 and type 2 error, power and size, p -values, Neyman-Pearson lemma, Wald, score/Rao, likelihood-ratio statistic, classical two-sample tests of means and proportions, sign test, permutation test, choice of test statistics Feb 25, Mar 4
- **Significance testing:** p -values, two-sided and one-sided, interpretation of statistical significance, interpretation of p -values, p -value functions, multiple testing, adjustment for selection, Bonferroni, Benjamini-Hochberg, false discovery rate control, goodness-of-fit tests, Bayesian hypothesis testing Mar 4, 11

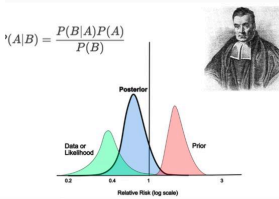
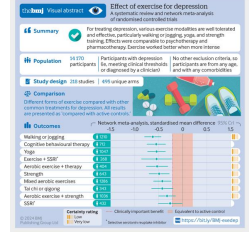
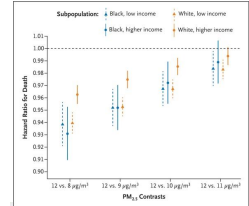
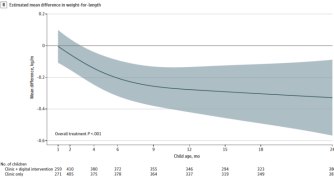
... Summary

- **Causality**: potential outcomes, counterfactuals, confounding, Simpson's paradox, observational studies, randomization, Bradford-Hill criteria, average treatment effect, conditional causal effect, association, adjustment for confounders, no un-measured confounding, propensity score, doubly robust estimation, graphical representations

Mar 18

- **Missing data**: types of missing data assumptions – MCAR, MAR, MNAR, likelihood inference, bias from MNAR, publication bias, meta-analysis, inverse probability weighting, funnel plots, forest plots

Mar 25



TOP STORY

Study suggests dogs may have self-domesticated for food

Research proposes that dogs may have domesticated themselves by opting to stay near humans for food, a process potentially driven by natural selection over 15,000 years. Published in the Proceedings of the Royal Society B, the study uses a statistical model to explore this hypothesis, suggesting that wolves who preferred human proximity and selected similarly tame mates could have initiated the domestication process. **Full Story:** [Live Science](#) (2/24)

According to one survey, only 31 per cent of Canadians trust AI. This is a problem



School phone bans alone do not improve grades or wellbeing, says UK study

Researchers say bans need to be part of wider strategy to tackle negative impact of mobile use on children



The negative effects of phone overuse did not differ between schools that banned phones and those that did not, the study found. Photograph: True Images/Getty

Gaza death toll 40% higher than official number, Lancet study finds

Analysis estimates death toll by end of June was 64,260, with 59% being women, children and people over 65



Could Dark Chocolate Reduce Your Risk of Diabetes?

A new study suggests that it might. We asked experts if that's too good to be true.

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Shutterstock/Corbis/Getty Images

The New York Times

Surgeon General Calls for Cancer Warnings on Alcohol

Dr. Vivek Murthy's report cites studies linking alcoholic beverages to at least seven malignancies, including breast cancer. But to add warning labels, Congress would have to act.

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The advisory called for updating labels on all alcoholic beverages with a warning that drinking heightens the risk for at least seven cancers, including common ones like breast and colon cancers. Ruth Fremson/The New York Times



I'll miss you but I won't miss this!!

Good luck on your exams