

## Course Agenda

# Fundamental concepts in medical statistics

Department of Pediatrics, Maharajgunj Medical Campus, Institute of Medicine, Tribhuvan University  
and  
Research Department, Institute of Medicine, Tribhuvan University  
Kathmandu, Nepal

In collaboration with

Centre for Fertility and Health, Norwegian Institute of Public Health and  
Bergen Centre for Ethics and Priority Setting in Health, University of Bergen, Norway

This intermediate level course aims to strengthen the basic understanding of fundamental concepts in medical statistics. The course is designed to stimulate participants to develop intuitive understanding of core statistical concepts through a combination of lectures, interactive sessions and hands-on exercises. The course is designed to provide broad general overview. The course will recap some basic topics such as significance testing, confidence intervals, linear regression and correlation, and introduce several important and useful techniques for analyzing clinical and epidemiological research data. The course is aimed at participants with some prior knowledge and experience of medical statistics and use of statistical tools.

Participants are expected to have carefully studied the course text "[Medical Statistics: A Textbook for the Health Sciences](#)", 5th Edition, by Walter, Campbell, and Machin (2021) before coming to the course physically. The course will be primarily based on R and R studio. A pre-course introductory day on R and R studio will be held on the 30<sup>th</sup> September.

### At the end of the course participants will be able to:

- Understand the basic interface and functionality of R and R studio and their application in medical statistics
- Understand and interpret the concept of p value and confidence intervals in medical statistics
- Conduct sample size calculations to achieve sufficient statistical precision and power in a study.
- Recognize situations where linear, binomial, and Poisson regression models are appropriate.
- Interpret results and effect measures from each of these models.
- Conduct standard survival analysis of time-to-event data and demonstrate awareness regarding challenges related to censoring data.
- Explain basic principles behind RCTs and how to analyze such data, as well as avoiding common pitfalls.
- Conduct regression analyses in R

### Faculty

Håkon K. Gjessing, PhD (<https://scholar.google.com/citations?user=H9TbeTIAAAAJ&hl=en>) is a Principal Investigator at the Centre for Fertility and Health, a Norwegian Research Council Center of Excellence located at the Norwegian Institute of Public Health, and an adjunct Professor of Biostatistics at the Department of Global Public Health and Primary Care, University of Bergen. Håkon is the lead faculty for the course and will share sessions with co-facilitators.

Co-facilitators: Dagrun Slettebø Daltveit, Ayushi and Devashish Tripathi.

**Pre course Day: Wednesday, September 30, 2026**

**Introduction to R program and R studio**

| <b>FOCUS OF THE DAY: Introduction to R and R studio</b> |               |                                                                                                                        |                                                  |
|---------------------------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
|                                                         | <b>Timing</b> | <b>Planned activity</b>                                                                                                | <b>Moderator</b>                                 |
|                                                         | 8:30- 9:00    | <b>Welcome remarks</b>                                                                                                 | Research Department and Department of Pediatrics |
|                                                         | 9:00- 10:00   | <b>R and R Studio Orientation</b><br>Navigating the interface, managing projects, and setting up the environment       | Ayushi, Devashish Tripathi and Jakob             |
|                                                         | 10:00- 11:00  | <b>R Fundamentals</b><br>Understanding variables, data types, and vectors.                                             | Ayushi, Devashish Tripathi and Jakob             |
|                                                         | 11:00- 12:00  | <b>Data Structures</b><br>Working with data frames and reading data into R (e.g., CSV, Excel)                          | Ayushi, Devashish Tripathi and Jakob             |
|                                                         | 12:00- 13:00  | <b>Lunch</b>                                                                                                           | Ayushi, Devashish Tripathi and Jakob             |
|                                                         | 13:00- 14:00  | <b>Data Manipulation &amp; Cleaning</b><br>Using packages like tidyverse::dplyr to select, filter, and summarize data. | Ayushi, Devashish Tripathi and Jakob             |
|                                                         | 14:00- 15:00  | <b>Data Visualization</b><br>Creating plots (e.g., scatter plots, histograms) using ggplot2.                           | Ayushi, Devashish Tripathi and Jakob             |
|                                                         | 15:00- 15:15  | <b>Tea</b>                                                                                                             | Ayushi, Devashish Tripathi and Jakob             |
|                                                         | 15:15- 16:15  | <b>Basic Statistics with R/R studio</b><br>Running introductory statistical tests (e.g., t-tests, ANOVA).              | Ayushi, Devashish Tripathi and Jakob             |

**Course day 1: Thursday, October 1, 2026**

| <b>FOCUS OF THE DAY: Overview, and fundamental concepts</b> |               |                                                                                                                                                                                                                                                                                                                                 |                                                         |
|-------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
|                                                             | <b>Timing</b> | <b>Planned activity</b>                                                                                                                                                                                                                                                                                                         | <b>Moderator</b>                                        |
|                                                             | 09:00- 10:00  | <b>Welcome and startup</b> <ul style="list-style-type: none"><li>Welcome/introduction</li><li>Quick overview of course and practical info</li><li>Quick overview of basic concepts (Participants are expected to have basic understanding of/experience with basic statistical concepts)</li></ul>                              | Håkon K. Gjessing                                       |
|                                                             | 10:00- 12:00  | <b>Fundamentals</b> <ul style="list-style-type: none"><li>Central limit theorem (most importantly, why it's useful)</li><li>General background on Confidence Intervals</li><li>Testing, p-values, one-sided vs. two-sided</li><li>Confidence intervals vs. testing</li><li>Transformation of data, the log-transform.</li></ul> | Håkon K. Gjessing                                       |
|                                                             | 12:00- 13:00  | <b>Lunch</b>                                                                                                                                                                                                                                                                                                                    |                                                         |
|                                                             | 13:00- 14:00  | <b>Exercises</b>                                                                                                                                                                                                                                                                                                                | Dagrun Slettebø Daltveit, Ayushi and Devashish Tripathi |
|                                                             | 14:00- 15:00  | <b>Sample size and statistical power / statistical precision</b> <ul style="list-style-type: none"><li>What it means</li></ul>                                                                                                                                                                                                  | Håkon K. Gjessing                                       |

|  |              |                                                                                                                                                                                                                                                                                   |                                                         |
|--|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
|  |              | <ul style="list-style-type: none"> <li>• How to restrict the probability of Type I/Type II errors</li> <li>• How to compute sample size needed for sufficient precision of effect estimate</li> <li>• How to compute sample size for study planning, simple situations</li> </ul> |                                                         |
|  | 15:00- 15:15 | <b>Tea break</b>                                                                                                                                                                                                                                                                  |                                                         |
|  | 15:15- 16:30 | <b>Exercises</b>                                                                                                                                                                                                                                                                  | Dagrun Slettebø Daltveit, Ayushi and Devashish Tripathi |

## Course day 2: Friday, October 2, 2026

| FOCUS OF THE DAY: Generalized linear models (GLMs) |              |                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                         |
|----------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
|                                                    | Timing       | Planned activity                                                                                                                                                                                                                                                                                                                                                                                                      | Moderator                                               |
|                                                    | 09:00- 11:00 | <b>Linear regression</b> <ul style="list-style-type: none"> <li>• Standard linear regression</li> <li>• Multiple linear regression, confounding, interpretation</li> <li>• Basic regression diagnostics</li> </ul>                                                                                                                                                                                                    | Håkon K. Gjessing                                       |
|                                                    | 11:00- 12:00 | <b>Exercises</b>                                                                                                                                                                                                                                                                                                                                                                                                      | Dagrun Slettebø Daltveit, Ayushi and Devashish Tripathi |
|                                                    | 12:00- 13:00 | <b>Lunch</b>                                                                                                                                                                                                                                                                                                                                                                                                          |                                                         |
|                                                    | 13:00- 15:00 | <b>Binomial regression</b> <ul style="list-style-type: none"> <li>• Binomial regression (including logistic regression)</li> <li>• Different link functions: logit, log, and identity</li> <li>• Corresponding interpretations: logistic, log, and additive</li> <li>• Odds Ratio (OR), Relative Risk (RR), and Risk Difference (RD)</li> <li>• Basic regression diagnostics</li> <li>• Poisson regression</li> </ul> | Håkon K. Gjessing                                       |
|                                                    | 15:00- 15:15 | <b>Tea break</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                                                         |
|                                                    | 15:15- 16:30 | <b>Exercises</b>                                                                                                                                                                                                                                                                                                                                                                                                      | Dagrun Slettebø Daltveit, Ayushi and Devashish Tripathi |

October 3, 2026 and October 4, 2026: Saturday and Sunday: Self-study

## Course day 3: Monday, October 5, 2026

| FOCUS OF THE DAY: Mixed bag with focus on RCTs, other experimental designs |              |                                                                                                                                                                                                                                    |                   |
|----------------------------------------------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
|                                                                            | Timing       | Planned activity                                                                                                                                                                                                                   | Moderator         |
|                                                                            | 09:00- 10:00 | <b>More on Binomial Regression</b> <ul style="list-style-type: none"> <li>• Link functions</li> <li>• How to choose suitable effect measures, such as RD, RR, OR</li> <li>• What are the implications of these choices?</li> </ul> | Håkon K. Gjessing |

|              |                                                                                                                                                                                                                                                                                                                        |                                                         |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| 10:00- 11:00 | <b>Interaction / effect measure modification</b> <ul style="list-style-type: none"> <li>• Basic concepts</li> <li>• Scale dependence</li> <li>• Examples How to estimate, variable coding, and dummy variables</li> <li>• Testing / estimating differences in effects across subgroups</li> </ul>                      | Håkon K. Gjessing                                       |
| 11:00- 12:00 | <b>Exercises</b>                                                                                                                                                                                                                                                                                                       | Dagrun Slettebø Daltveit, Ayushi and Devashish Tripathi |
| 12:00- 13:00 | <b>Lunch</b>                                                                                                                                                                                                                                                                                                           |                                                         |
| 13:00- 14:00 | <b>Some fundamental ideas behind RCTs</b> <ul style="list-style-type: none"> <li>• The causal reasoning behind randomization</li> <li>• Adjustment for baseline variables? Other adaptations</li> <li>• Regression to the mean, need for trial comparator arm, etc.</li> <li>• Dropouts, intention to treat</li> </ul> | Håkon K. Gjessing                                       |
| 14:00- 14:15 | <b>Tea break</b>                                                                                                                                                                                                                                                                                                       |                                                         |
| 14:15- 15:00 | <b>A “Modeling Case study” using binomial, Poisson, and time-to-event in COVID-19 modeling</b>                                                                                                                                                                                                                         | Håkon K. Gjessing                                       |
| 15.15- 15:45 | <b>Weighted analyses</b> <ul style="list-style-type: none"> <li>• Frequency weights</li> <li>• Sampling weights</li> <li>• Importance weights</li> </ul>                                                                                                                                                               | Håkon K. Gjessing                                       |
| 15:45- 16:30 | <b>Exercises</b>                                                                                                                                                                                                                                                                                                       | Dagrun Slettebø Daltveit, Ayushi and Devashish Tripathi |

#### Course day 4: Tuesday, October 6, 2026

| FOCUS OF THE DAY: Count data, standardization |              |                                                                                                                                                                                                                                                                                                 |                                                         |
|-----------------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
|                                               | Timing       | Planned activity                                                                                                                                                                                                                                                                                | Moderator                                               |
|                                               | 09:00- 11:00 | <b>Poisson regression</b> <ul style="list-style-type: none"> <li>• How and when to use</li> <li>• How to handle varying exposure time, use of offset</li> <li>• Examples from Covid-19 pandemic analyses</li> </ul>                                                                             | Håkon K. Gjessing                                       |
|                                               | 11:00- 12:00 | <b>Exercises</b>                                                                                                                                                                                                                                                                                | Dagrun Slettebø Daltveit, Ayushi and Devashish Tripathi |
|                                               | 12:00- 13:00 | <b>Lunch</b>                                                                                                                                                                                                                                                                                    |                                                         |
|                                               | 13:00- 15:00 | <b>Standardization methods</b> <ul style="list-style-type: none"> <li>• Standardized averages for continuous data</li> <li>• Standardized risks and rates</li> <li>• Standardized Mortality Ratios (SMRs)</li> <li>• Model-based standardization, examples of how to present results</li> </ul> | Håkon K. Gjessing                                       |
|                                               | 15:00- 15:15 | <b>Tea break</b>                                                                                                                                                                                                                                                                                |                                                         |
|                                               | 15:15- 16:30 | <b>Exercises</b>                                                                                                                                                                                                                                                                                | Dagrun Slettebø Daltveit, Ayushi and Devashish Tripathi |

**Course day 5: Wednesday, October 7, 2026**

| <b>FOCUS OF THE DAY: Survival and event history analysis</b> |               |                                                                                                                                                                                                     |                                                         |
|--------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
|                                                              | <b>Timing</b> | <b>Planned activity</b>                                                                                                                                                                             | <b>Moderator</b>                                        |
|                                                              | 09:00- 11:00  | <b>Survival Analysis / Event History Analysis</b> <ul style="list-style-type: none"><li>• Introduction to survival/event history analysis</li><li>• Kaplan-Meier</li><li>• Cox regression</li></ul> | Håkon K. Gjessing                                       |
|                                                              | 11:00- 12:00  | <b>Exercises</b>                                                                                                                                                                                    | Dagrun Slettebø Daltveit, Ayushi and Devashish Tripathi |
|                                                              | 12:00- 13:00  | <b>Lunch</b>                                                                                                                                                                                        |                                                         |
|                                                              | 13:00- 14:00  | <b>Additional topics in survival analysis</b> <ul style="list-style-type: none"><li>• Alternative models, such as additive hazards model</li></ul>                                                  | Håkon K. Gjessing                                       |
|                                                              | 14:00- 15:15  | <b>Summary discussion and evaluation</b>                                                                                                                                                            | All                                                     |
|                                                              | 15:15- 15:30  | <b>Tea</b>                                                                                                                                                                                          |                                                         |
|                                                              | 15:30- 16:00  | <b>Valedictory session</b>                                                                                                                                                                          | All                                                     |

**Teaching language:** English

**Course fee:** None