Statistical Analysis with R for Research

Md. Jubayer Hossain

CHIRAL Bangladesh

Founder & Exectutive Director

Instructor, Data Science for Biologists

cBLAST, University of Dhaka

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Agenda

- Who We Are
- What We Do
- Workshop Overview
- What you will learn?
- Let’s Get Started!

Welcome!

Welcome to the Statistical Analysis with R for Research Workshop! This 1-day intensive program is designed to equip researchers, students, and professionals with essential R programming skills for statistical analysis.

Who We Are

About Us

Legal Information

Center for Health Innovation, Research, Action, and Learning (CHIRAL Bangladesh) is a non-profit, non-governmental organization currently undergoing registration with the Registrar of Joint Stock Companies and Firms (RJSC) as **CHIRAL Foundation**. Our Taxpayer Identification Number (TIN): 154198266266.

Mission

Solving public health problems and improving quality of life through modern biomedical research.

Vision

To be a leading multidisciplinary research organization leveraging data and AI for impactful solutions.

What We Do

Building Next Generation Scientists

- Training on Python, R and SPSS for Research Data Analysis
- Training on Multi-omics (Genomics, Proteomics, Transcriptomics) Big Data for Cancer Research
- Training on Machine Learning and Deep Learning for Public Health/Bioinformatics
- Training on Remote Sensing and GIS for Public Health
- Research Internship Program

Research Groups

- **Population Health Studies Division (PHSD)**
  - Cancer Epidemiology, Neuroepidemiology, Vector-born Diseases, Mental Health
- **Big Bioinformatics Lab (BBL)**
  - Cancer Bioinformatics, Computational Epigenetics, Neurodegenerative Diseases and Cancer
- **Geospatial Health Research Group (GHRG)**
  - Climate Impact on Health, AI Integration with Geospatial Health
- **AI for Health (AI4H)**
  - AI Application in Health focusing on Cancer and Neurological Disorders

Our Collaborators

Dr. Kelly Hirko, Michigan State University

Project: Breast cancer prevention and awareness breast self-examination among school and college-going girls in Bangladesh

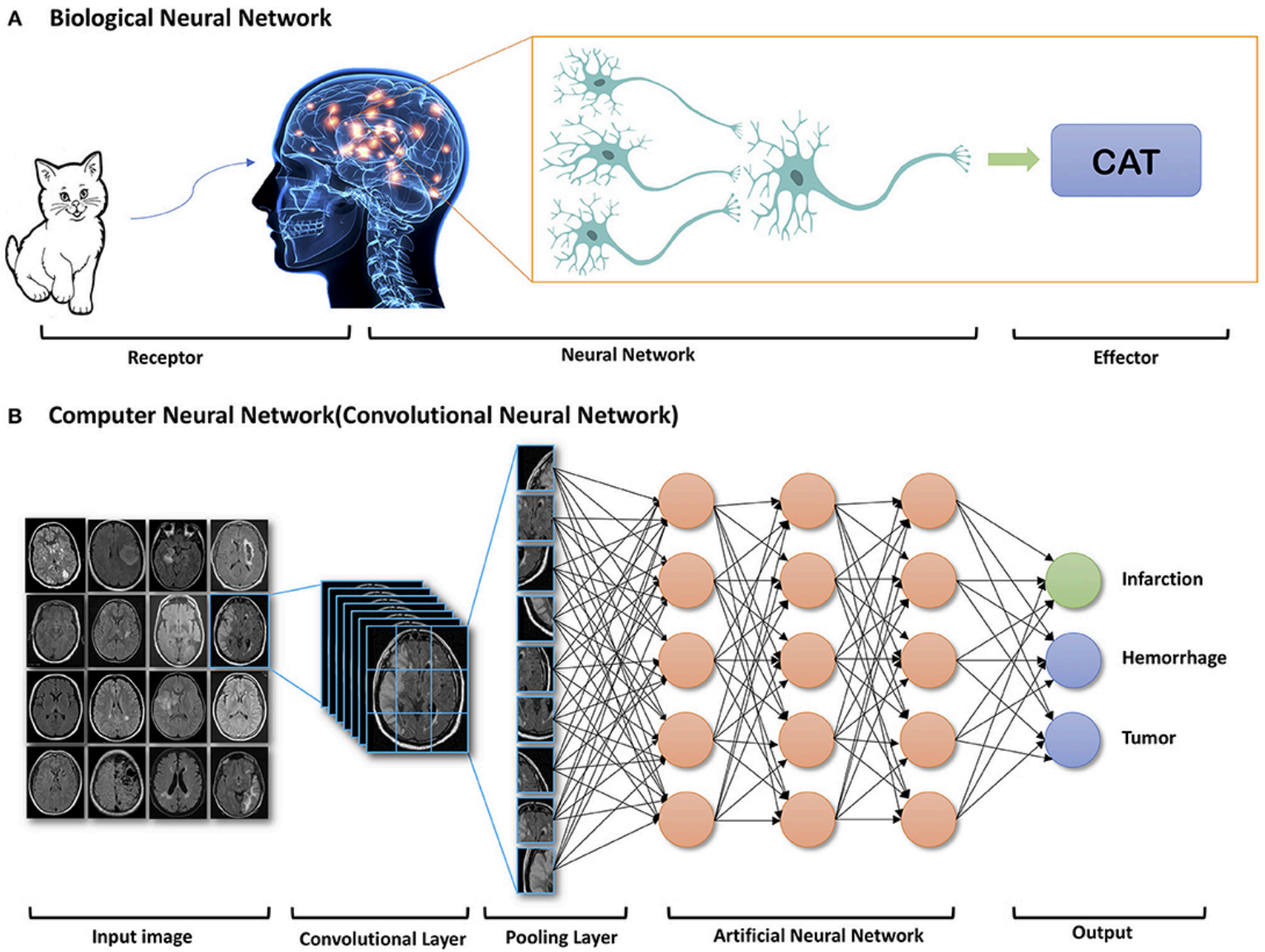
Dr. Md. Salequl Islam, One Health Lab, Jahangirnagar University

Project: One-Health Assessment of Emerging Antimicrobial Resistance Genes (ARGs) in Bangladeshi Livestock, Soil, Environment, and Human: Tackling the Crisis Together funded by the Bangladesh Academy of Sciences and United States Department of Agriculture (BAS-USDA).

Dr. Md. Salequl Islam, Sher-e-Bangla Agricultural University

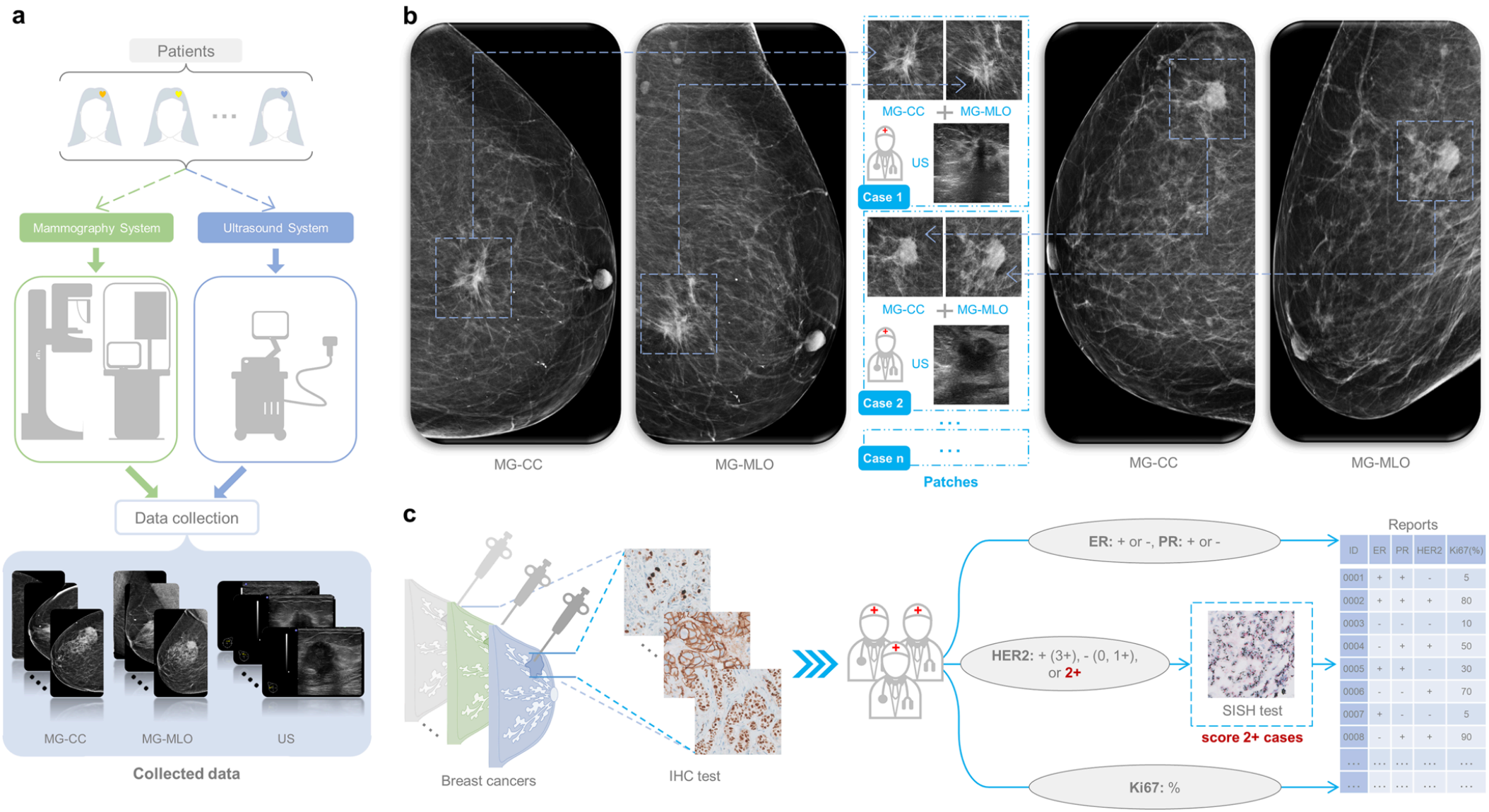
Project: RNA-Seq Meta Analysis on Heat Shock Genes

AI and Neuro-Imaging Techniques



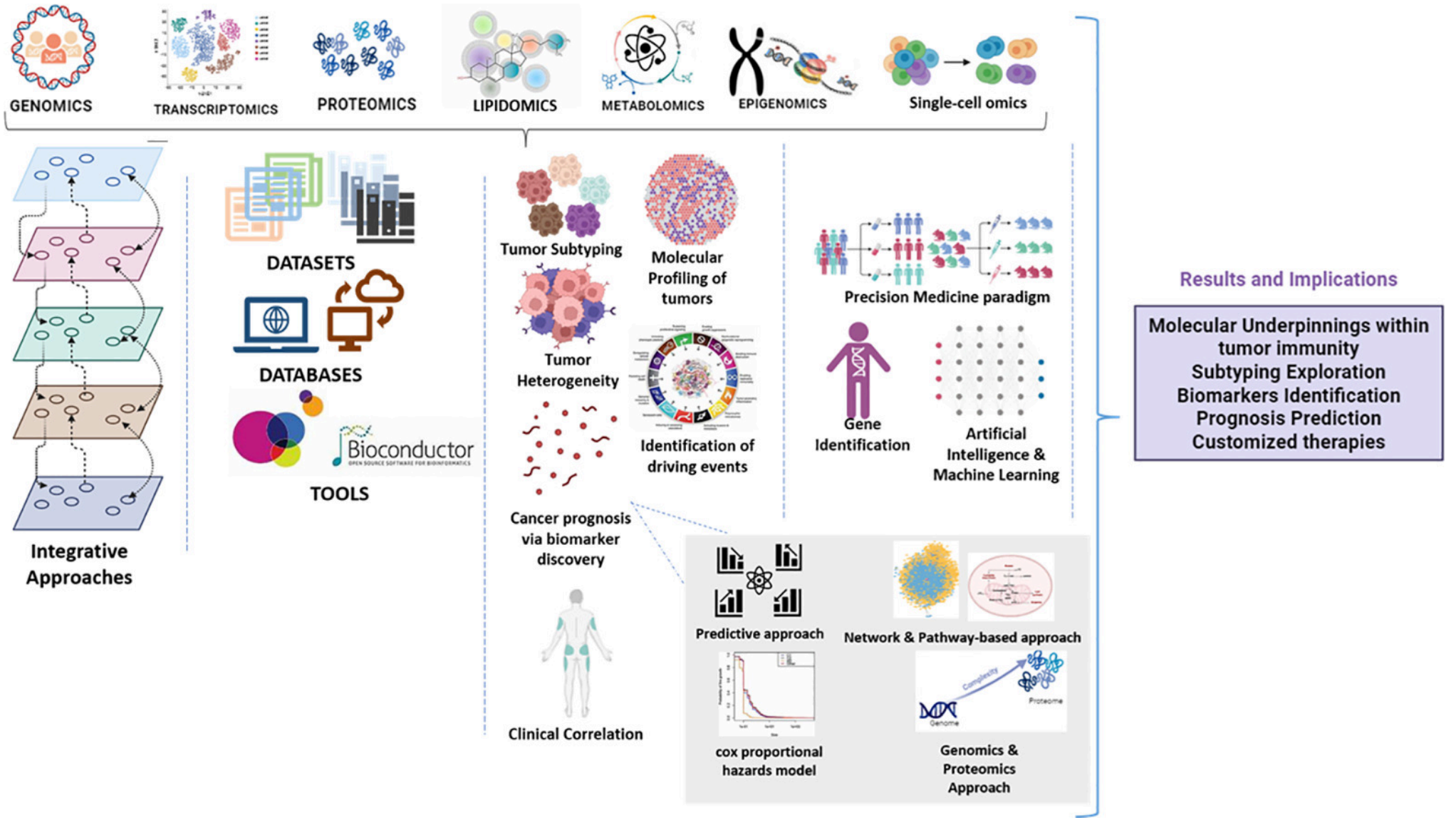
Zhu et al. 2019

AI for Breast Cancer Detection



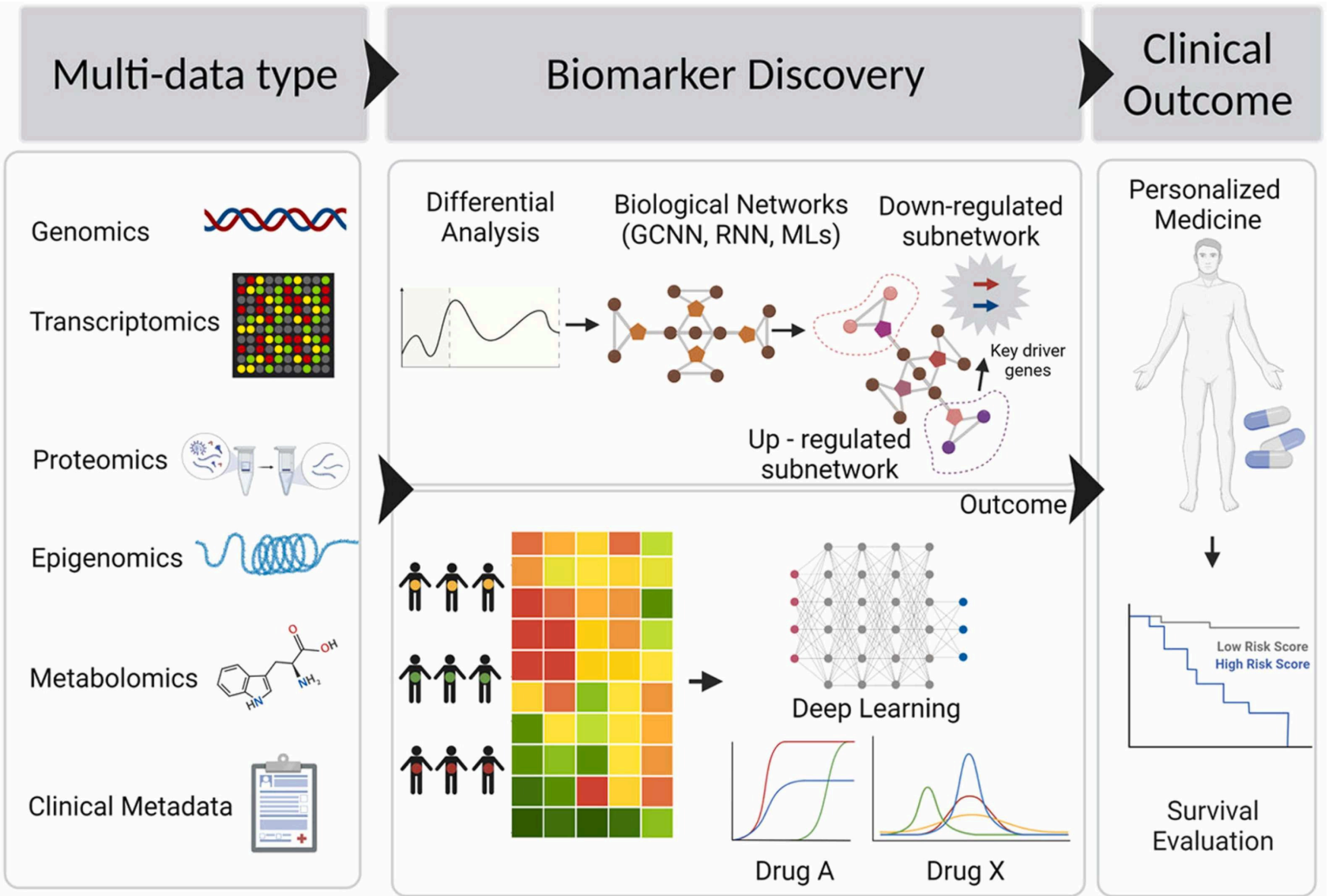
Tan et al. 2023

Multi-omics Big Data for Cancer Research



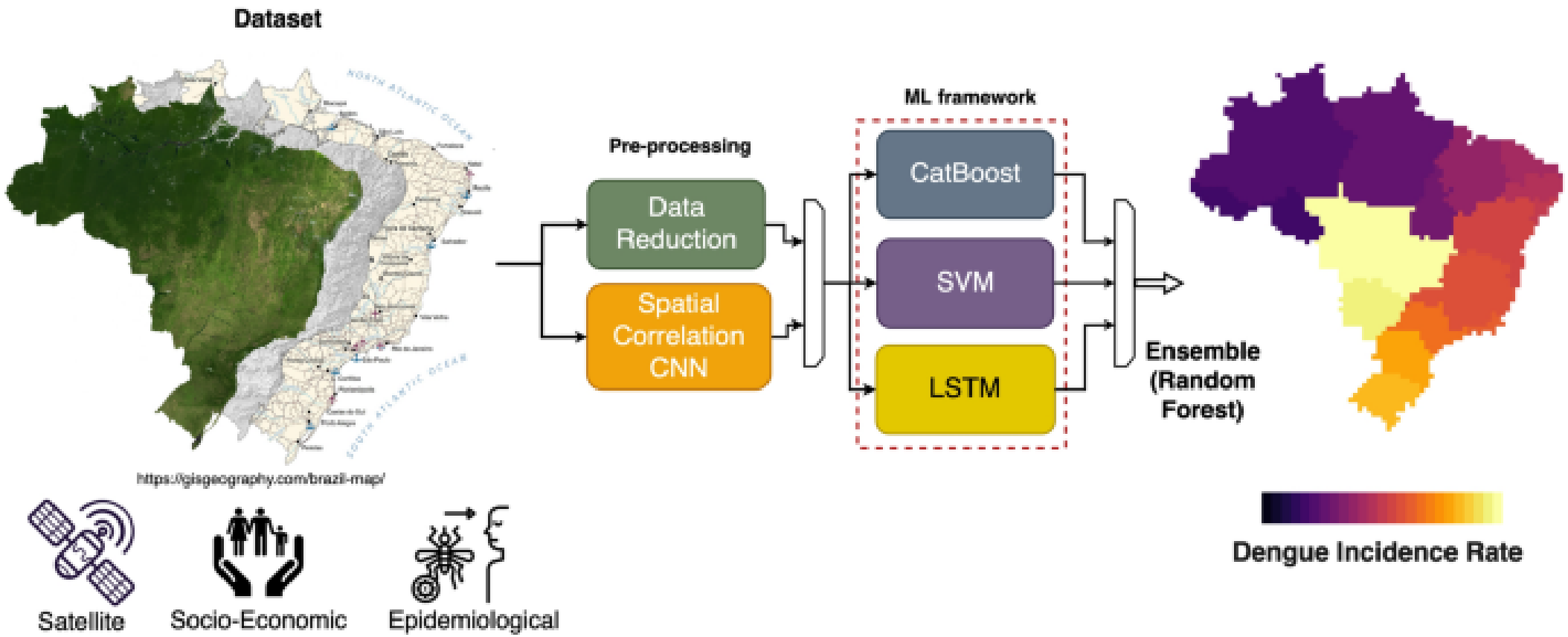
Chakraborty et al. 2024

Deep Learning and Multi-omics Big Data



Mathema et al. 2023

Machine Learning Approach to Forecast Dengue Outbreaks



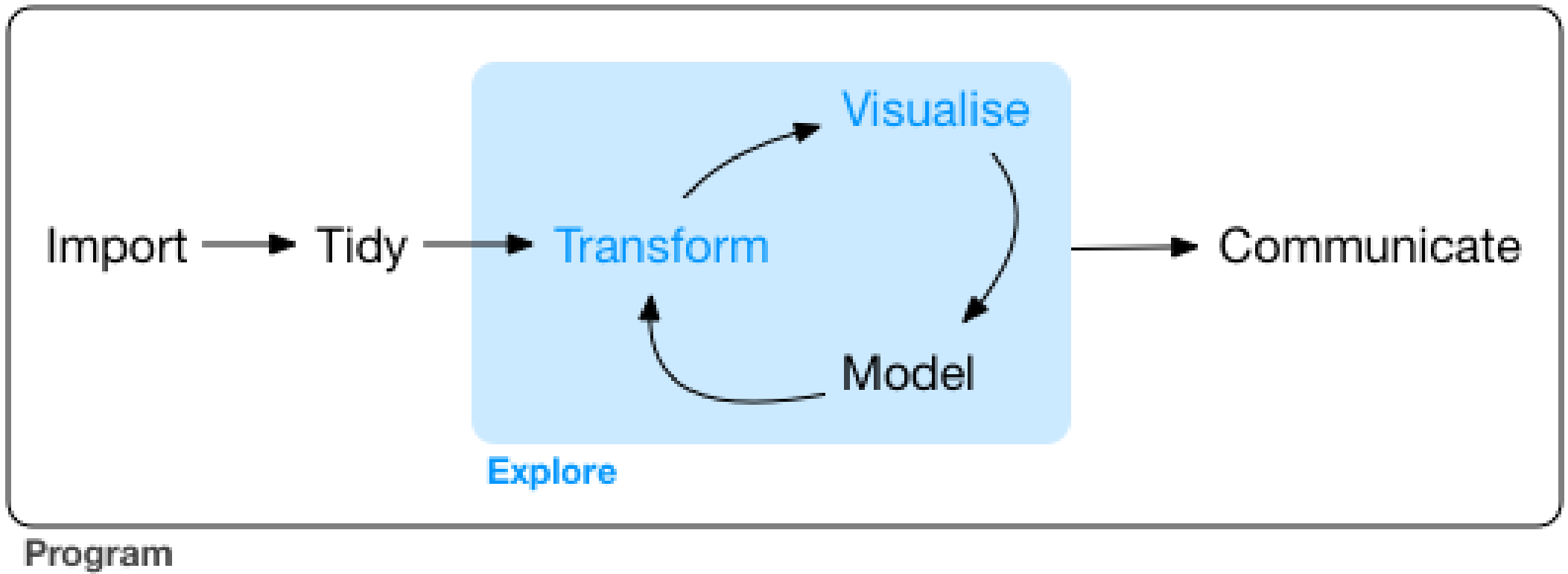
Sebastianelli et al. 2024

Workshop Overview

Learning Objectives

- `Data Manipulation:` Learn how to import, clean, and transform data in R for research purposes.
- `Data Visualization:` Master techniques for creating effective data visualizations in R to communicate research findings visually.
- `Statistical Analysis:` Develop skills in conducting statistical analysis using R for hypothesis testing, regression analysis, and other statistical tests.
- `Reproducible Research:` Implement principles of reproducible research using R to document and organize code, data, and analysis for replicability.

Workflow



https://r4ds.had.co.nz/

Course Platforms

- Website: https://chiraltraining.github.io/SAR/
- Github: https://github.com/chiraltraining/SAR

> We are constantly trying to improve content! Please refresh/download materials before class.

Session Format

- Lecture with live coding (possibly “Interactive”)
- Practical experience
- Participants must run code with the instructors using the provided R script
- 10 mins breaks each session - timing may vary

Required Textbooks

The following books purchased and are available online!

- Applied Medical Statistics for Beginners by Dr. Mohamed Elsherif
- Introduction to R Programming by Dr. Roger D. Peng
- R for Data Science by Roger D.Peng
- Exploratory Data Analysis with R by Roger D.Peng

What is R?

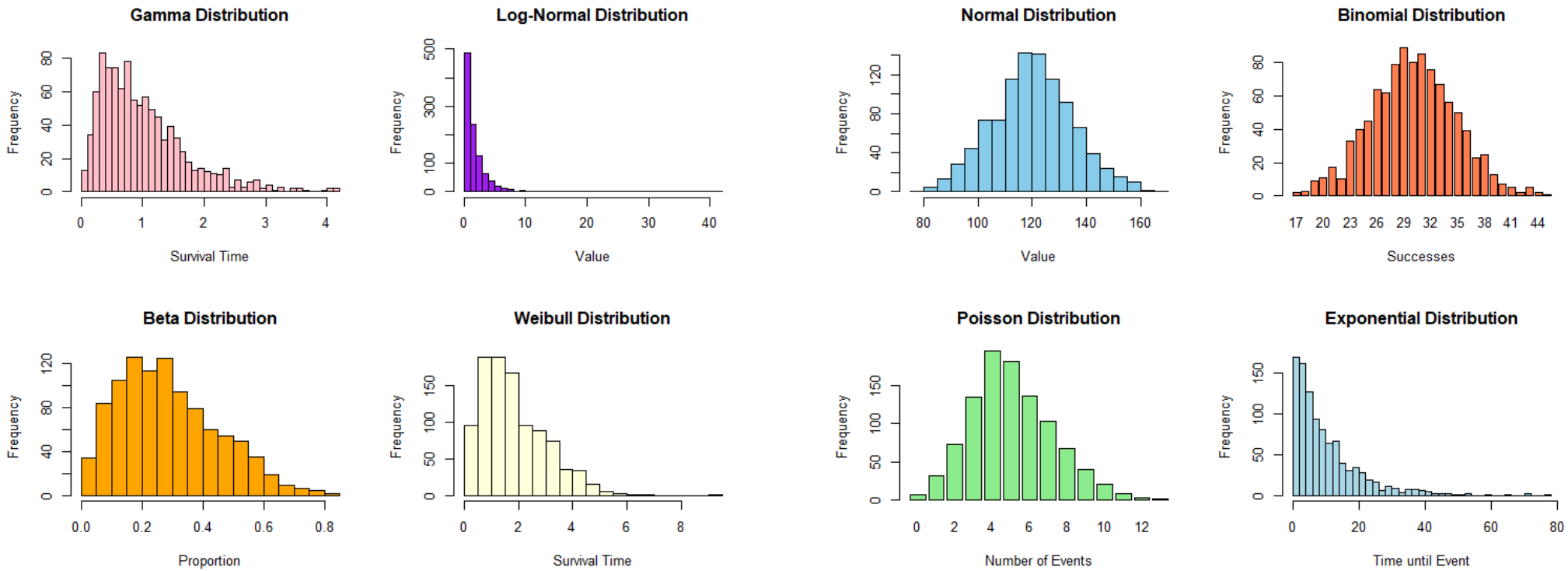
- R is a language and environment for statistical computing and graphics developed in 1991.
- R is the open source implementation of the S language, which was developed by Bell laboratories in the 70s.
- The aim of the S language, as expressed by John Chambers, is “to turn ideas into software, quickly and faithfully”
- R is both open source and open development.
- The aim of the S language, as expressed by John Chambers, is “to turn ideas into software, quickly and faithfully”

Why R?

- Free (open source)
- High level language designed for statistical computing
- Powerful and flexible - especially for data wrangling and visualization
- Extensive add-on software (packages)
- R is popular – and increasing in popularity.
- R runs on all platforms.(Windows, Linux and Mac)
- R is being used by the biggest tech giants(google, facebook, microsoft, twitter)
- Strong community

What you will learn?

Probability Distributions



Publication-ready Descriptive Tables

Characteristic	**Overall** N = 200[1]	**Drug A** N = 98[1]	**Drug B** N = 102[1]
Age	47 (38, 57)	46 (37, 60)	48 (39, 56)
Unknown	11	7	4
Grade			
I	68 (34%)	35 (36%)	33 (32%)
II	68 (34%)	32 (33%)	36 (35%)
III	64 (32%)	31 (32%)	33 (32%)

[1] Median (Q1, Q3); n (%)

Publication-ready Analytical Tables

Characteristic	**Overall** N = 200[1]	**Drug A** N = 98[1]	**Drug B** N = 102[1]	**p-value**[2]
Age	47 (38, 57)	46 (37, 60)	48 (39, 56)	0.7
Unknown	11	7	4	
Grade				0.9
I	68 (34%)	35 (36%)	33 (32%)	
II	68 (34%)	32 (33%)	36 (35%)	
III	64 (32%)	31 (32%)	33 (32%)	

[1] Median (Q1, Q3); n (%)

[2] Wilcoxon rank sum test; Pearson's Chi-squared test

Publication-ready Regression Tables

Characteristic	N	OR[1]	95% CI[1]	p-value
Age	183	1.02	1.00, 1.04	**0.10**
Grade	193			
I		—	—	
II		0.95	0.45, 2.00	0.88
III		1.10	0.52, 2.29	0.81

[1] OR = Odds Ratio, CI = Confidence Interval

Introduction to the Tidyverse - Echosystem

https://www.tidyverse.org/

Framework for Easy Statistical Modeling, Visualization, and Reporting

https://easystats.github.io/easystats/

Let’s Get Started!