

We  a community

Development of (local) E-learning platforms in (bio)statistics
& data science: The >eR-BioStat platform

Ziv Shkedy

Hasselt University, Belgium

CFAR Symposium on Statistics and Data Science in HIV

June, 5&6, 2023

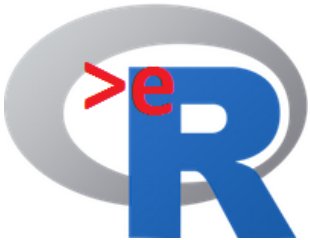


ER-BioStat

<https://erbiostat.wixsite.com/erbiostat>

GitHub  <https://github.com/eR-Biostat>

twitter  @erbiostat



The >eR-BioStat :
short introduction about the ITP project

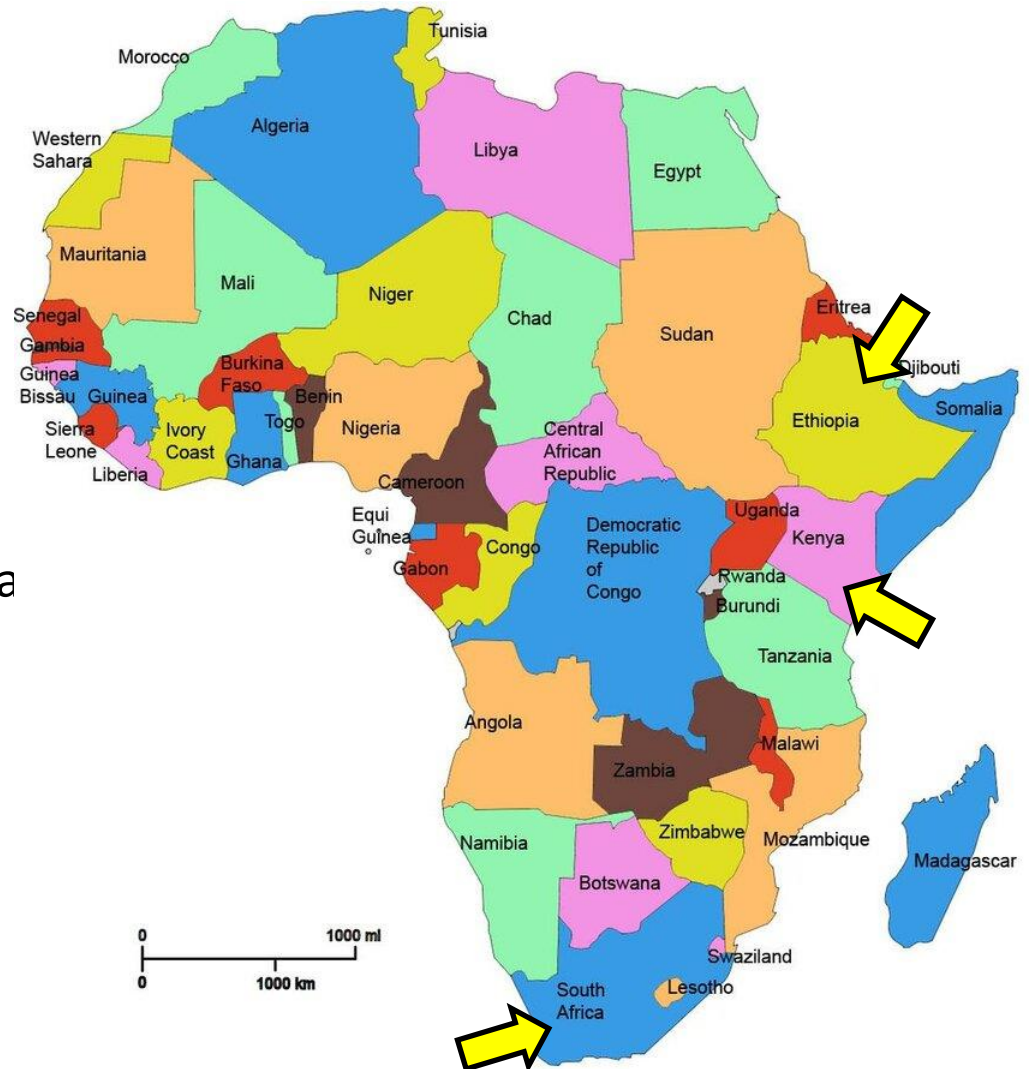
Our new website

<https://erbiostat.wixsite.com/erbiostat>



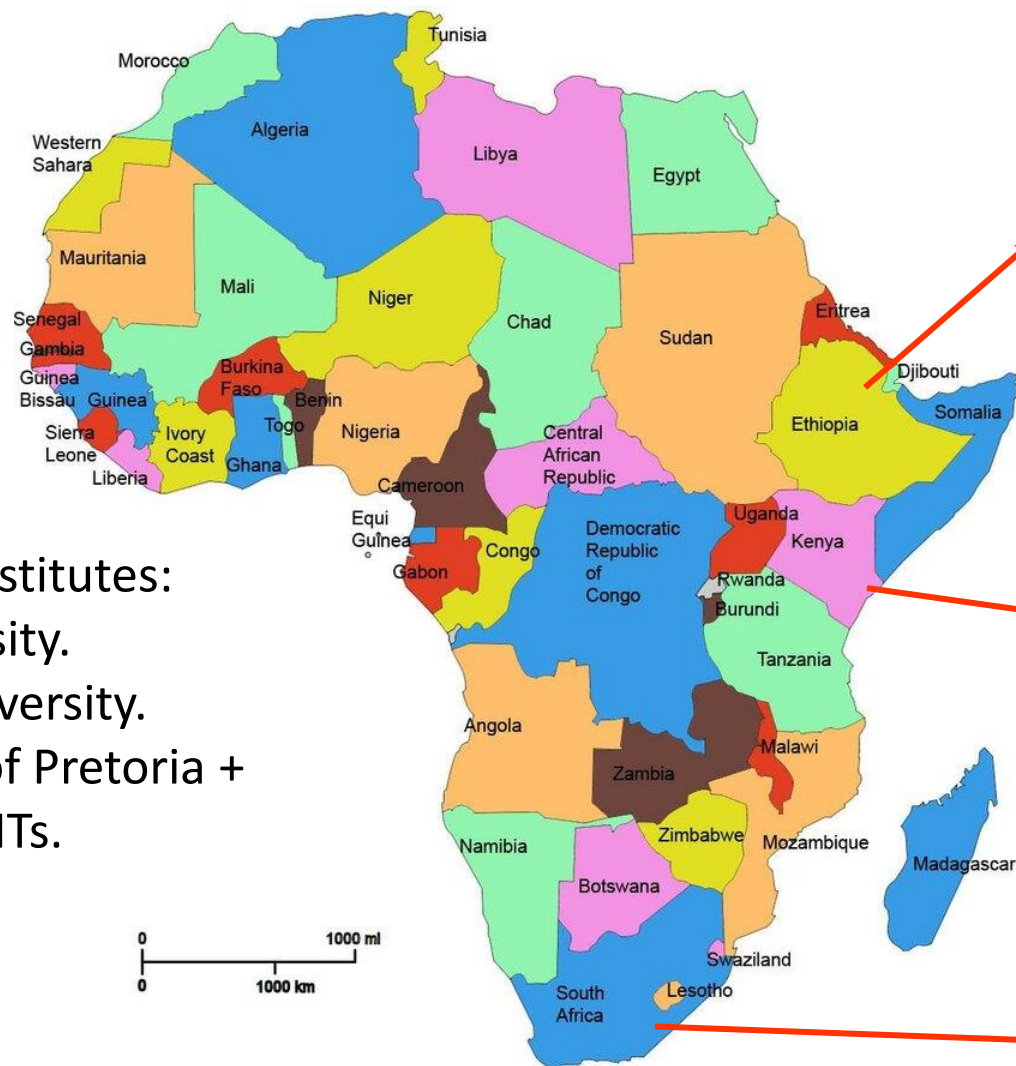
Project's structure

- Three years project.
- Three countries:
 - Kenya.
 - Ethiopia.
 - South Africa.
- In total: 14+ Universities & institutes from the three countries.
- International team: USA, Canada Belgium.





Project's partners



Gondar University.

Ambo University,
Debre Berhan University
Arba Minch University.
+others....

Moi University.

Karatina University.
JKUAT.
Masinde Muliro Uni.

University of Pretoria. MRC-SA. WITS.

Stellenbosch University.
The University of Venda.
The University of Zululand.

- Three leading institutes:
 - Moi University.
 - Gondar University.
 - University of Pretoria + SA-MRC, WITs.



Project's focus

- ITP: **I**nternational **T**raining **P**rogram.
- Focus: Development of (local) E-learning and digital education platforms for (bio)statistics & data science.
- All levels of HE:
 - Undergraduate.
 - Graduate.
 - Service courses for non statisticians.



Project's focus

- Development of (**local**) networks of universities in Kenya, Ethiopia, South Africa that use the digital platform for statistics & DS.
- Establish international network to support local universities.



Deliverable

- A Local version of the >eR-BioStat website.
- Updated global version of <https://erbiostat.wixsite.com/erbiostat>.
- “Editorial board” for the website.



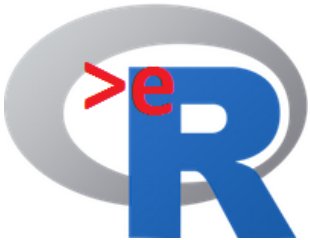
Activities

- Workshops for training in the local universities:
 - 3 workshops per country (we aim for one per year) = 9 workshops in total.
 - Up to a 5-10 days workshop.
 - ~20 participants (local & international): for the partner institutes + others.
- Workshops will be located in the leading partners.
- Online workshops (~3).



Project duration

- Sponsor: VLIR-UOS.
- Three academic years: 23/24, 24/25 & 25/26.
- First workshop: Gondar (14/08/2023).
- Second workshop: SA-MRC, cape town (end of February 24: workshop + conference).
- Third workshop: Moi.
- ...
- ...



The >eR-BioStat :
a very short introduction and main concepts

Our new website

<https://erbiostat.wixsite.com/erbiostat>



Digital education & E-learning

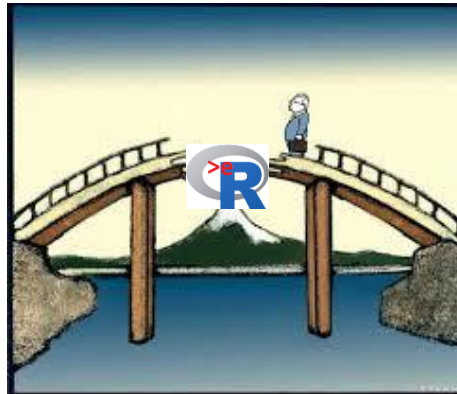
- We **DO NOT** develop online education program but we develop **online materials for on campus** education.
- The E-learning Initiative aims to **support on campus programs** by:
 - Develop accessible course materials in (bio)statistics.
 - Focus on **all education levels**:
 - Undergraduate & master programs, PhD schools.
 - Statisticians & non statisticians.
 - Bring students and teachers costs to minimum by providing **free, high quality and applied** course materials.



We  a community

- Build up communities (in south & north).
- Create a bridge between communities:

Academic staff and students in the south.



Development of
E- learning capacity

Academic staff in the north.



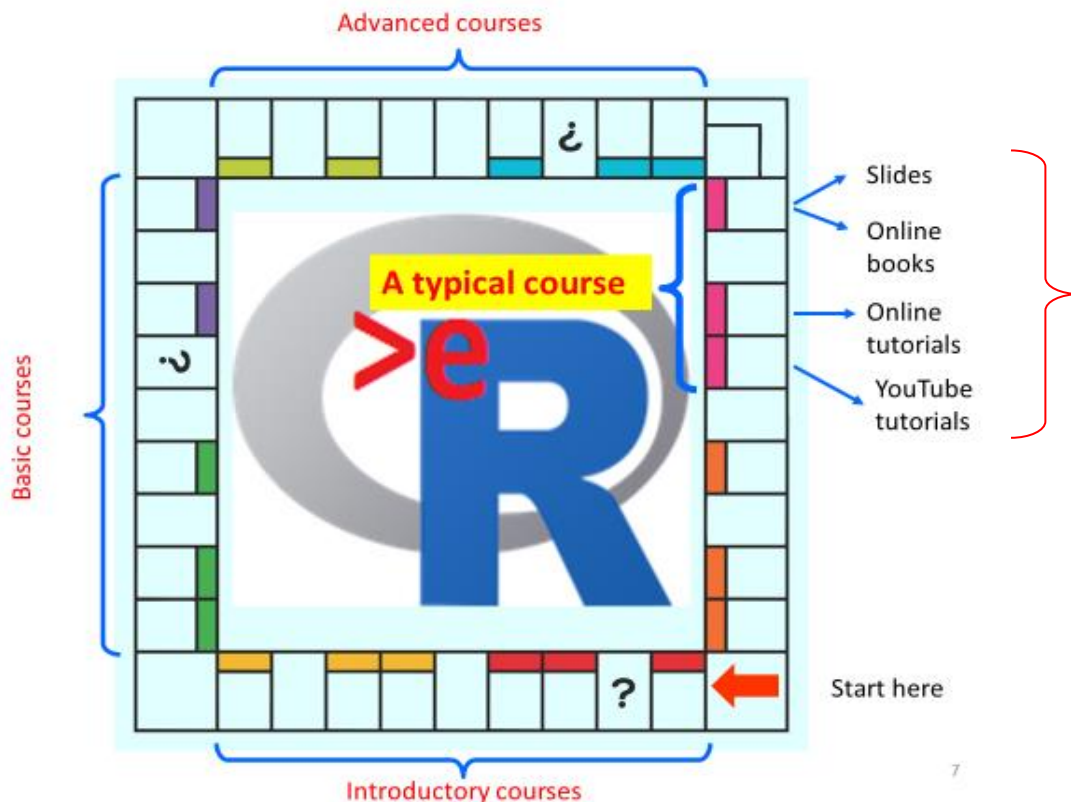
Concepts

- The E-learning system consists of few components:
 1. All course materials are available to the students/teachers online to download.
 - Can be used **online or offline**.
 2. Selected courses were/will be developed.
 3. Courses can be used either as a complete course or a part of a course.
 4. Courses developed up to a class level, i.e. courses are ready to be given in the class.



Typical course structure

- Courses in three levels: introductory, basic & advanced.
- What does it mean “fully develop a course...” ?



- Course materials are ready to be used in class.
- **Open source policy !!!**



Our approach (1): free and publicly available

- Reduce costs to zero !!!
- Use publicly available products:
 - Storage course materials: GitHub (<https://github.com/>).
 - Website development: WIX (<https://www.wix.com/>).
 - Software: mostly publicly available software.
 - For example:
 - R (<https://www.r-project.org/>).
 - Python (<https://www.python.org/>).

All publicly
available
products.



- Free for users(=students/teachers in the south):
 - No password.
 - No registration.



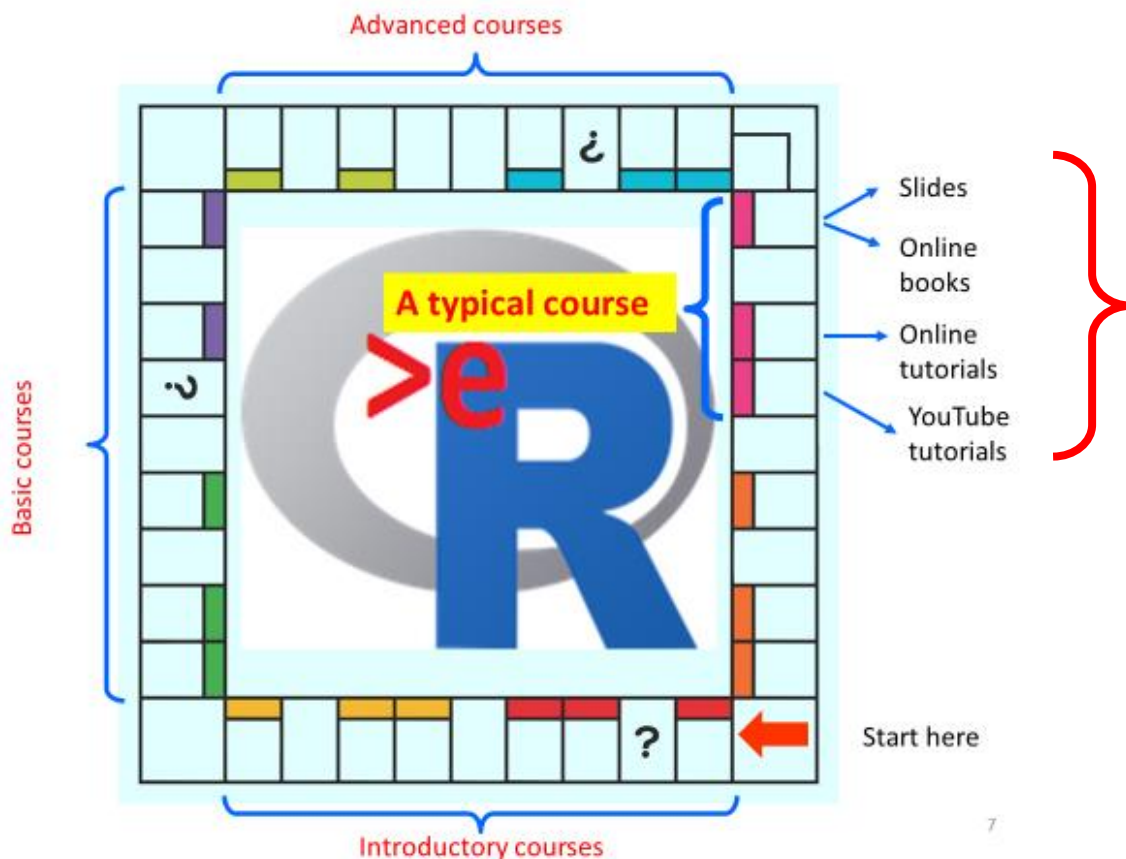
Our approach (2): open source

- For a given course, everything is available for free:
 - Slides for the class (pdf).
 - Source files to make the slides (PP, Tex, Rmd...) !!!
 - YouTube tutorials.
 - Software programs for the examples in the course.
- Free for users:
 - No password.
 - No registration.

All publicly available.



Our approach (3): Communities



- All source materials are available for **FRRE** online.
- Everybody can download and use.



- Course materials **can be adapted** by the users for the local needs.

- Communities of users: students & teachers in the south &
- Communities of developers: in both south & north.



The >eR-BioStat : where to find us ?

Our new website

<https://erbiostat.wixsite.com/erbiostat>



We R online

- We provide **an online and free** platform:

<https://erbiostat.wixsite.com/erbiostat>

This site was designed with the **Wix**.com website builder. Create your website today. [Start Now](#)

>eR

Home We R a community Our platform Our courses Gallery Developers Blog

E-learning using R: **Biostatistics** [Log In](#)

>eR-BioStat

Welcome to the 2020 edition of the **>eR-BioStat** initiative website. We are a part of the open-source movement and we offer free courses in statistics. If you are a teacher that needs to give a course in statistics or a student that studies a course in statistics, we are the address. Just [click](#) on the link, [download](#) the materials (for free) and [teach](#) (yourself) in the class. In the next few weeks, we will update and refresh our curriculum. If you want to be updated, follow us on social media and follow our blog. All our courses, as before, are available online in our Github [page](#).

The **>eR-BioStat** initiative
Making & biostat education accessible to all
We **R** a community: the **>eR-BioStat** initiative
Dr. Maëly Adriaens, Ghent University & Statistics Institute
Hasselt University, Belgium, Durham University, UK, Vrije Universiteit Amsterdam, The Netherlands
Ghent University, Ghent, Belgium
Contact: maely.adriaens@ugent.be
Website: <https://erbiostat.wixsite.com/erbiostat>

[CHAT WITH US](#)



Open source


Inbox (4,678) - ziv.shkedy@uhas... x wix Home | Erbiostat x +

erbiostat.wixsite.com/erbiostat

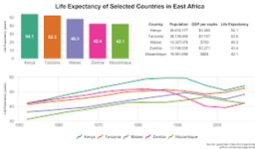
Apps uhaselt.be bookmarks

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Our platform



Online Courses



Life Expectancy of Selected Countries in East Africa



OPEN SOURCE

Our courses

We offer courses at different levels. The **green courses** are developed at an introductory level. Only basic level knowledge of statistics and R is required. These courses were developed for both non statisticians and statisticians. The courses within this cluster can also be used as courses to support R usage in undergraduate program in biostatistic/statistics. The **blue courses** are developed at a basic undergraduate level in statistics. A basic level knowledge of statistics and R is required at the beginning of the course. The courses aim to teach the students basic topics on specific subjects. The **orange courses** are more advanced and are focused on basic statistical modeling and inference methods at a master level.

Courses' structure

We offer few course structures, all of them were developed up to a class level course. Typically, a course in the >eR-BioStat platform consists of

- Slides.
- R programs for the examples discussed in the slides.
- Datasets.
- YouTube tutorials.

Open source

Our **open source** policy means that course materials, slides, programs for the examples discussed in the courses, are available for you. In some courses, source files for the presentations/course notes are available in PowerPoint or markdown files. Our aim is to have, as much that it is possible, a complete open source curriculum by the end of 2022.

Courses marked with red sticker are fully open source.

Courses marked with blue sticker are under development and not presented in their final version.

[CHAT WITH US](#)

Type here to search

25°C Zonnig 16:17 03/09/2021

- We provide the source files for the courses:
 - PPT/Tex/Rmds for slides.
 - Rmds and R programs.



Our courses

- Courses in three levels:

- **Introductory.**
- **Basic.**
- **Advanced.**

The screenshot shows a web browser displaying the Erbiostat website. The page title is "Our courses". The website is built with Wix.com. The page is organized into three main sections: Introductory, Basic, and Advanced. Each section contains a list of courses. The Introductory section has 6 courses, the Basic section has 3, and the Advanced section has 9. A "CHAT WITH US" button is located at the bottom right of the page.

Introductory	Basic	Advanced
Introduction to R		Applied Generalized Linear Models (GLM) using R
Statistical modeling: Linear regression using R		Modelling Binary Data using R
Statistical modeling: One-way ANOVA using R		Longitudinal data analysis (LDA) using R
Statistical modeling: Logistic regression using R		Linear models using R
Visualizing data using R: an introduction		Survival Analysis using R
Basic concepts of statistical inference using R		An introduction to bootstrap using R
	Basic concept in statistical inference using R (1)	Sample size calculation using R
	Basic concept in statistical inference using R (2)	Exploratory multivariate data analysis using R
	Linear Regression using R	Survival Analysis using R (A)

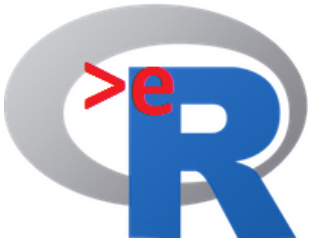
- Target for **September 2023**: all courses are ready to be given in class.
- To select a course: click on the course name.



The >eR-BioStat : example of one course
Introduction to R

Our new website

<https://erbiostat.wixsite.com/erbiostat>



Example: introduction to R

Wix Home | Erbiostat

erbiostat.wixsite.com/erbiostat

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Our courses

Introductory

- Introduction to R
- Statistical modeling: Linear regression using R
- Statistical modeling: One-way ANOVA using R
- Statistical modeling: Logistic regression using R
- Vizualizing data using R: an introduction
- Basic concepts of statistical inference using R

Basic

- Basic concept in statistical inference using R (1)
- Basic concept in statistical inference using R (2)
- Linear Regression using R

Advanced

- Applied Generalized Linear Models (GLM) using R
- Modelling Binary Data using R
- Longitudinal data analysis (LDA) using R
- Linear models using R
- Survival Analysis using R
- An introduction to bootstrap using R
- Sample size calculation using R
- Exploratory multivariate data analysis using R
- Survival Analysis using R (A)

[CHAT WITH US](#)

Waiting for engage.wixapps.net...

Type here to search

17:00
12/03/2023



Example: introduction to R

Inbox (4,678) - ziv.shkedy@uhas... x WIX Home | Erbiostat x WIX Home | Rintro x +

erbiostat.wixsite.com/rintro

Apps uhasse.lt.be bookmarks Reading list

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Introduction to R

>eR-BioStat

Home About **Topics** Online book Contact

This course is an introductory course to R and can be given as a one/two-days workshop or as a course of 2-3 classes (3 hours per class). All topics in the course are presented at a basic level. Only a limited knowledge in R is required. Topics covered in the course include:

- Two sample t-test.
- Basic plots
- Basic programming in R: objects in R
- Reading external datasets
- Basic plots functions
- Programming in R: a for loop
- Statistical modeling in R: simple linear regression
- Statistical modeling in R: one-way ANOVA
- Statistical modeling in R: logistic regression
- Programming in R: user functions
- Two-way ANOVA
- Application of a for loop: bootstrap.
- The tidyverse package.

The course was developed as a [introductory level](#) course.

R Console

```
R version 3.6.1 (2019-05-14) -- "Mendelius"
Copyright (C) 2019 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help,
'help.start()' for an HTML browser interface to help,
Type 'q()' to quit R.

> library(RStudio)
Error: had previous file magic number (file may be corrupt
or deleted). Moving message:
file 'RStudio' has magic number '0001'
Use of this version prior to 2 is deprecated
During this up - Warning message:
cannot set the type event data to 'RStudio'
> plot(arqualityWind, arqualityZone)
> plot(arqualityWind, arqualityZone, col='red')
> plot(arqualityWind, arqualityZone, col='red', pch=1)
```

Graphics Device 2 (GCTD)

arqualityWind

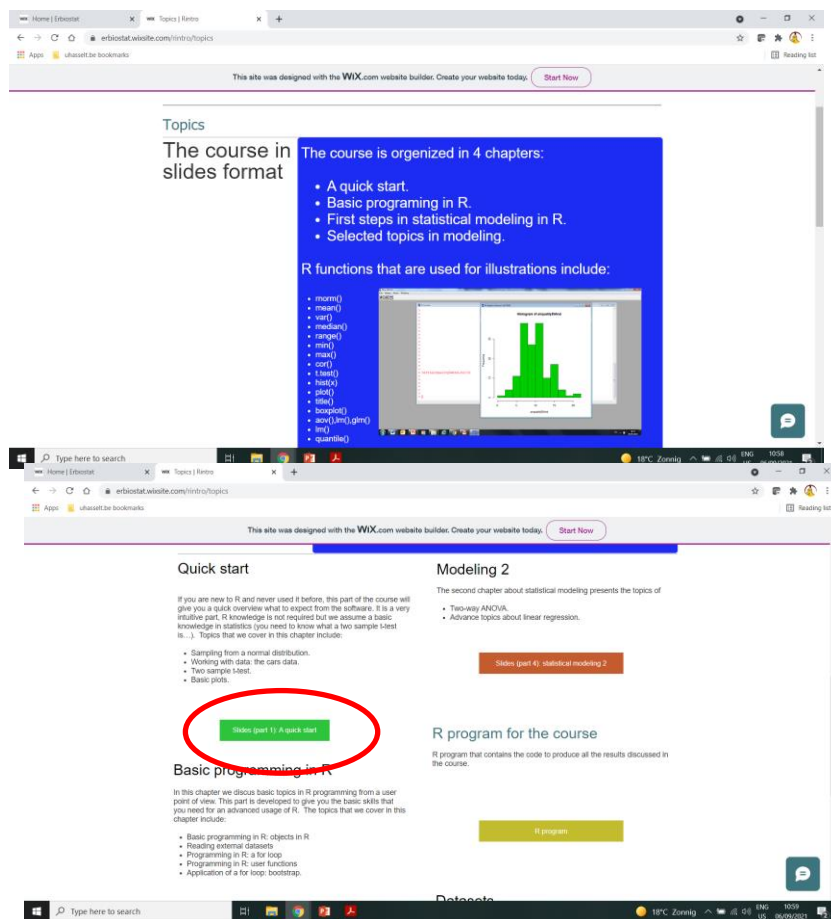
arqualityZone

<https://erbiostat.wixsite.com/rintro>



Slide format (in “Topics”)

- The course in a usual slides format:
 - Slides (PDF).
 - Slides (Power point).
 - R program to produce the results presented in the slides.






Slide format (PDF)

Home | Erbiostat x Topics | Rintro x Courses/eR-Biostat_An Introducti x +

github.com/eR-Biostat/Courses/blob/master/Introductory%20Courses/Introduction%20to%20R/Slides/eR-Biostat_An%20Introduction%20to%20R_2017_QuickStart.pdf

Apps uhasse.lt.be bookmarks Reading list



The >eR-Biostat initiative
Making R based education materials in
statistics accessible for all

An introduction to R: Short Version (2017)

Part 1: a quick start

Developed by
Dan Lin (Hasselt University) and Ziv Shkedy (Hasselt University)

LAST UPDATE: 15/10/2017

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Online book

Inbox (4,678) - ziv.shkedy@uhas... x WIX Home | Erbiostat x WIX Home | Rintro x +

erbiostat.wixsite.com/rintro

Apps uhasse.lt.be bookmarks Reading list

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Introduction to R

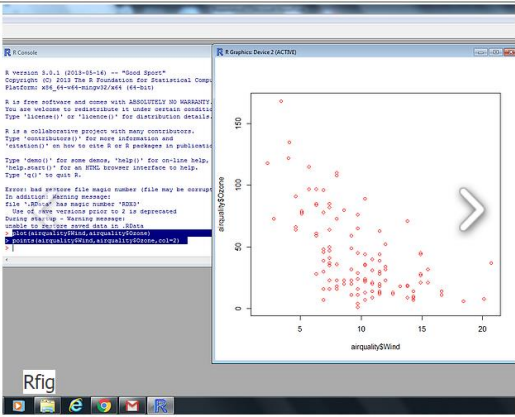
>eR-BioStat

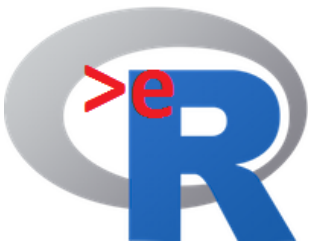
[Home](#) [About](#) [Topics](#) [Online book](#) [Contact](#)

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- Two-way ANOVA
- Application of a for loop: bootstrap.
- The tidyverse package.

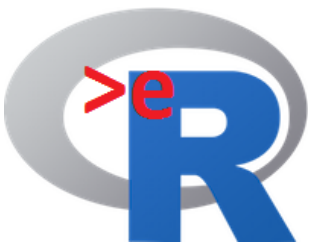
The course was developed as a [introductory level](#) course.





Online book

- Available in
 - HTML.
 - PDF.
 - Rmd to reproduce the book on your laptop.



Online book

WU Home | Erbiostat x Online book | Rintro x Introduction to R: basic program x +

Not secure | https://github.com/eR-BioStat/Courses/blob/master/Introductory%20Courses/Introduction%20to%20R/Onlinebook/Rintro_Prog-html-_V1.html

Apps uhaselt.be bookmarks Reading list

Introduction to R: basic programming

- 1 Introduction
 - 1.1 Slides, code and tutorials
 - 1.2 R ?
 - 1.3 Slides
- 2 R Objects
 - 2.1 YouTube tutorial: objects in R
 - 2.2 Introduction
- 3 Basic plots in R
 - 3.1 Introduction
 - 3.2 Graphical functions (I)
 - 3.3 Graphical functions (II): the law school data
- 4 Summary statistics

Ziv Shkedy
Hasselt University, Belgium
May, 2020

1.3 Slides

Slide for this part of the course are available online in the >eR-BioStat website. See [RcourseProgramming](#).

2 R Objects

2.1 YouTube tutorial: objects in R

For a short YouTube introduction, by Mike Marin, about objects in R see [YTobjects1](#).

2.2 Introduction

R works with objects. An object in R could be a scalar, for example

```
x <- 1
```

We can print the object x :

```
print(x)
```

```
## [1] 1
```

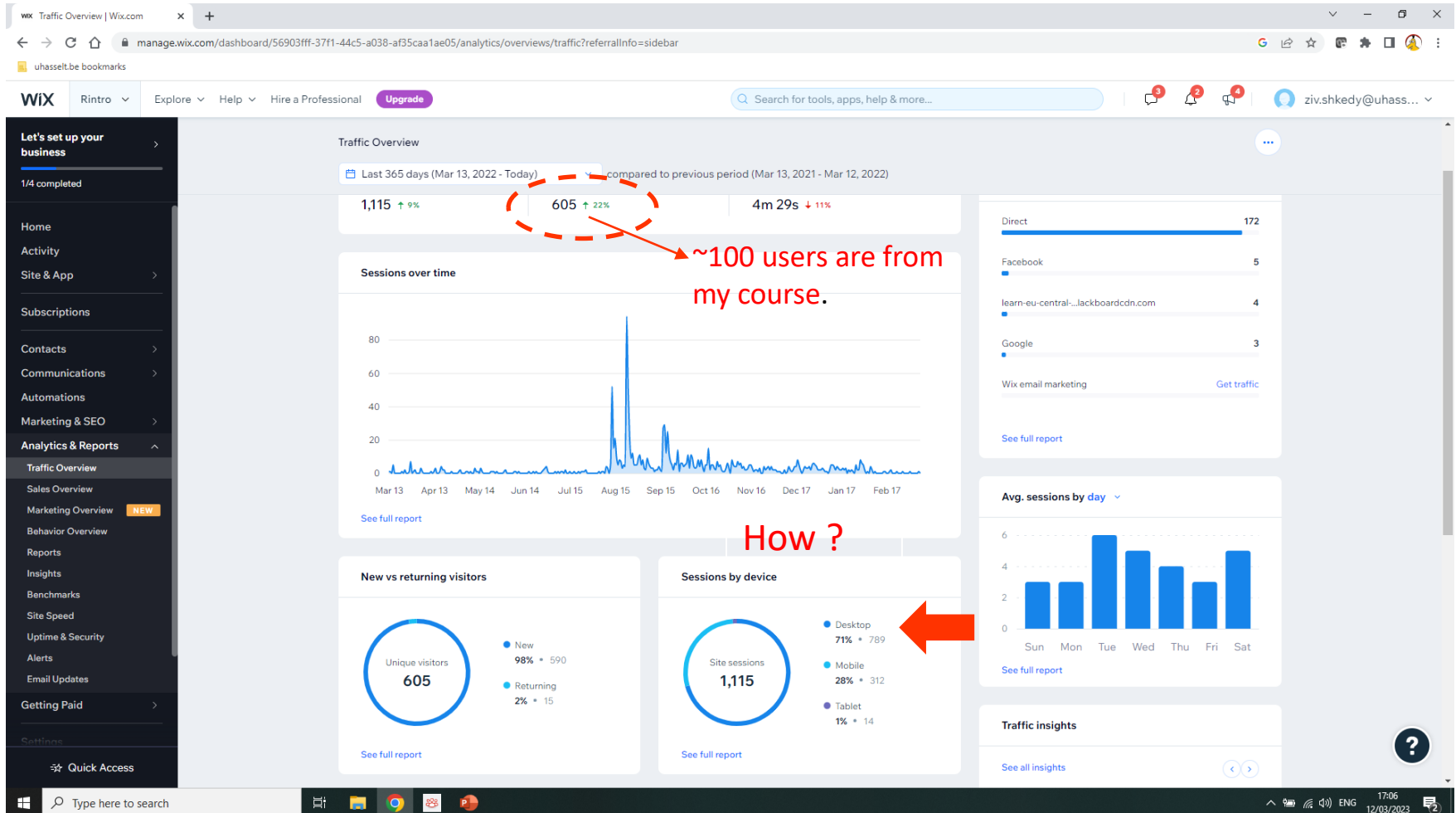
The object x can be a vector defined using the R function c()

Links to the course slides and YouTube tutorials from the book.



R course: users in the last 365 days

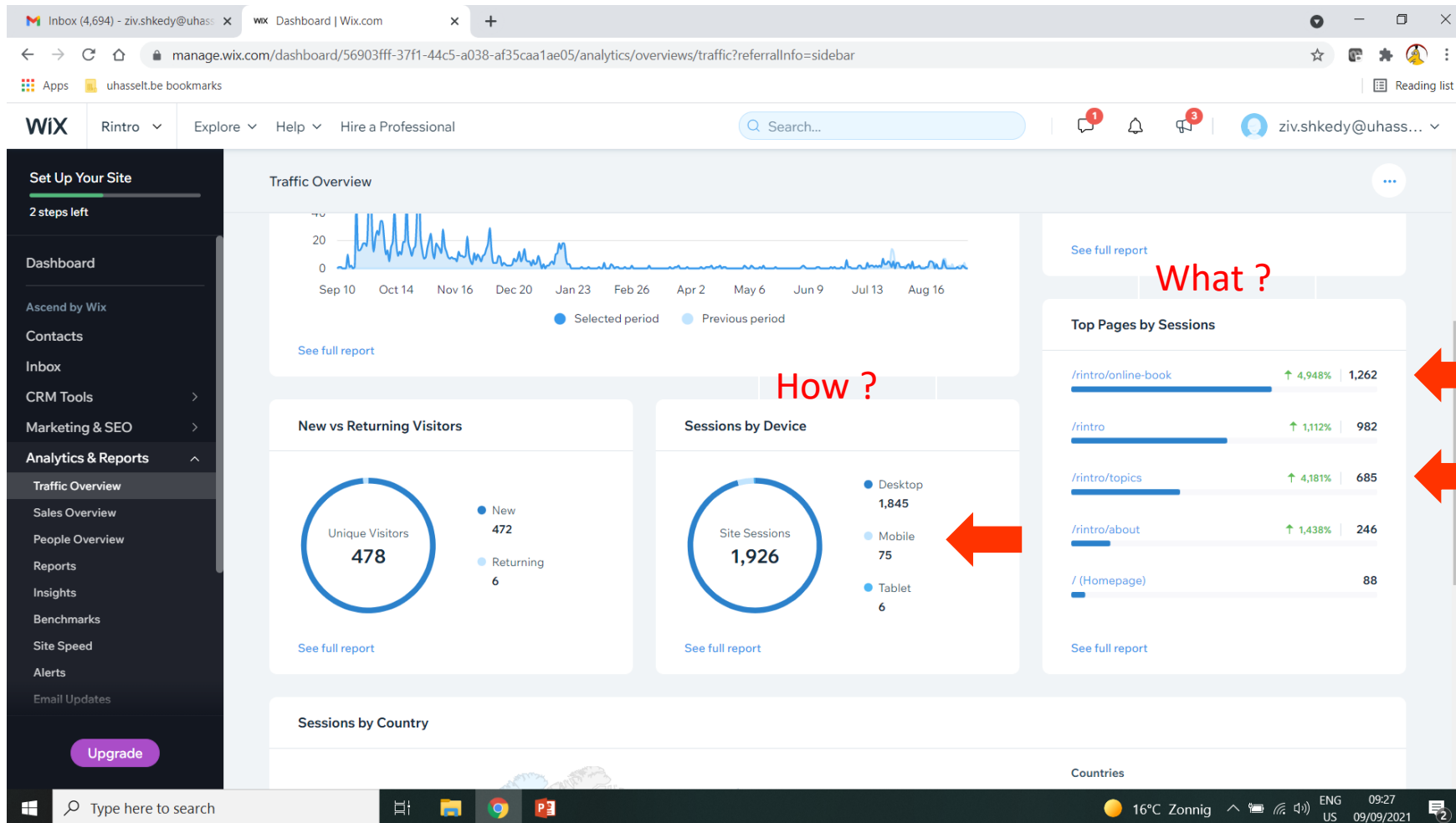
13/03/2022-12/03/2023:605 users.





How our users use the website ? (Introduction to R)

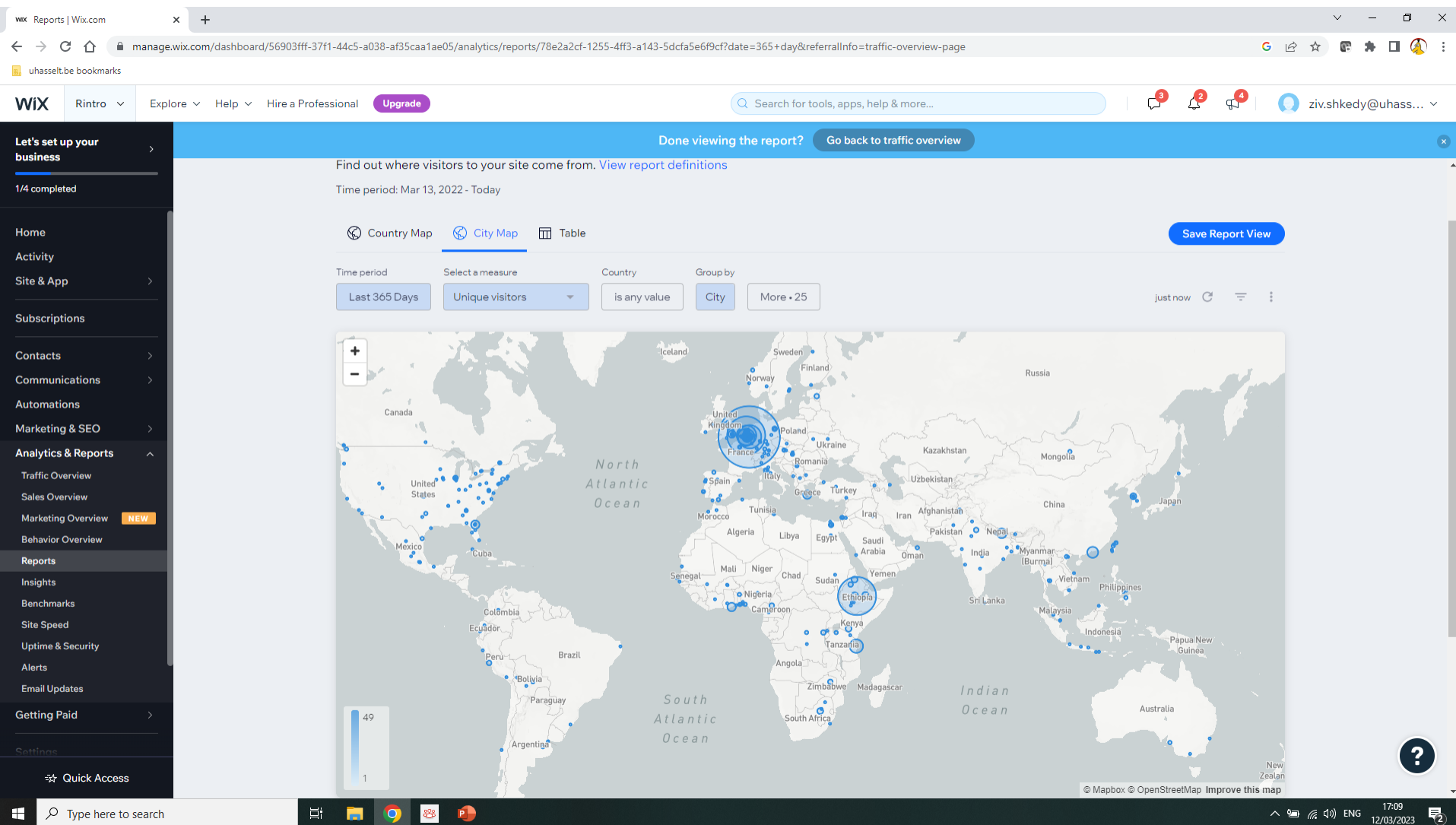
For 2021





Who are our users? (Introduction to R)

13/03/2022-12/03/2023





Stay connected



Interuniversity Institute for Biostatistics
and statistical Bioinformatics

- Look for more examples & courses in our website:

<https://erbiostat.wixsite.com/erbiostat>

- Users:
 - Want to take part in our initiative ?
 - Want to include your university in our initiative ?
 - Want to use our courses for your classes ?
- Developers:
 - **Want to contribute a course for this initiative ?**
- Send us an email !!!

ziv.shkedy@uhasselt.be

- Follow us on social media:



Visit us on
Facebook

ER-BioStat

&



@erbiostat



Interuniversity Institute for Biostatistics
and statistical Bioinformatics

Thank you very much !!

Join our community and look for us online:



ER-BioStat

<https://erbiostat.wixsite.com/erbiostat>

GitHub  <https://github.com/eR-Biostat>

twitter  @erbiostat

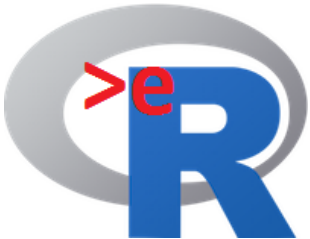
Some extra slides about the ITP project



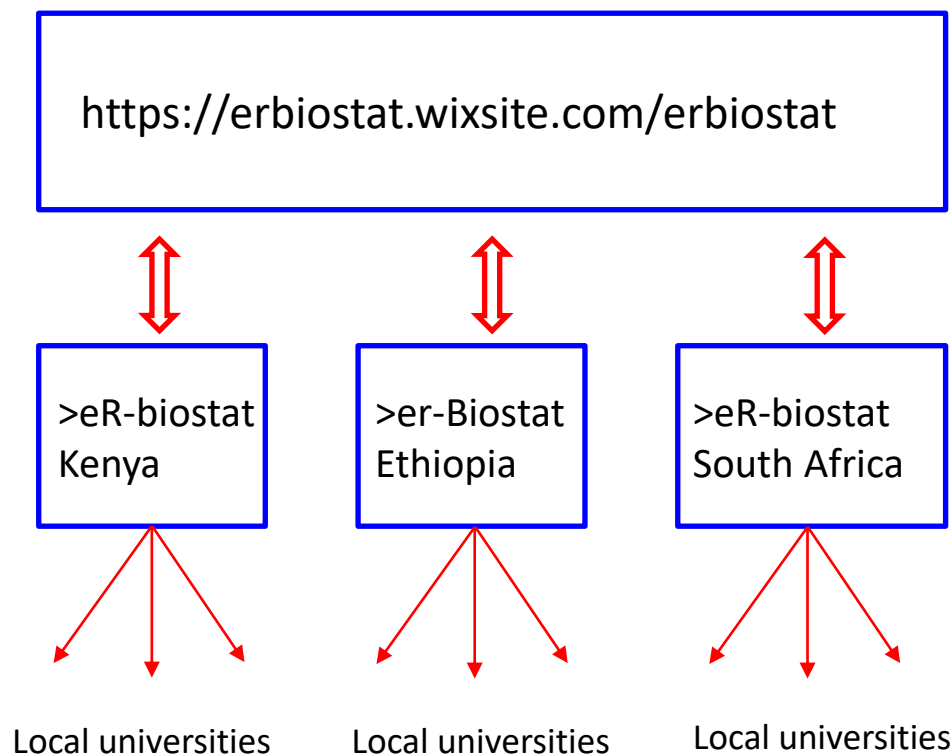
The >eR-BioStat platform: global & local websites & collaborators

Our new website

<https://erbiostat.wixsite.com/erbiostat>



Online structure



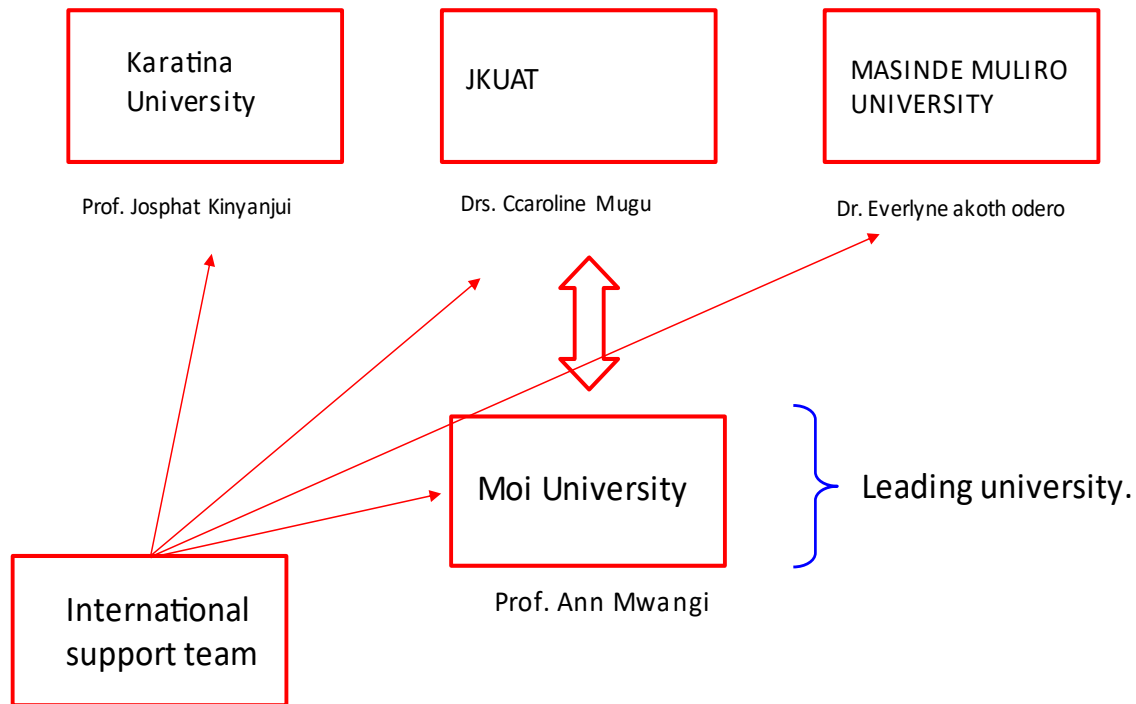


Collaborators network (South partners)

- Kenya:
 - [Moi University.](#)
 - Karatina University, The Department of Mathematics, Statistics and Actuarial Science.
 - Jomo Kenyatta University of Agriculture and Technology (JKUAT) ,The department of Statistics and actuarial science.
 - Masinde Muliro University of Science and Technology, department of statistics.
- Ethiopia:
 - [Gondar University.](#)
 - Ambo University, The department of statistics.
 - Arba Minch University, The Department of Statistics.
 - Debre Berhan University (DBU), Statistics Department.
- South Africa:
 - [University of Pretoria.](#)
 - [MRC-SA.](#)
 - [WITS.](#)
 - Stellenbosch University (SU), the division of epidemiology and biostatistics.
 - The University of Venda, The Department of Mathematical and Computational Sciences.
 - The University of Zululand (UNIZULU), The Department of Mathematical Science.

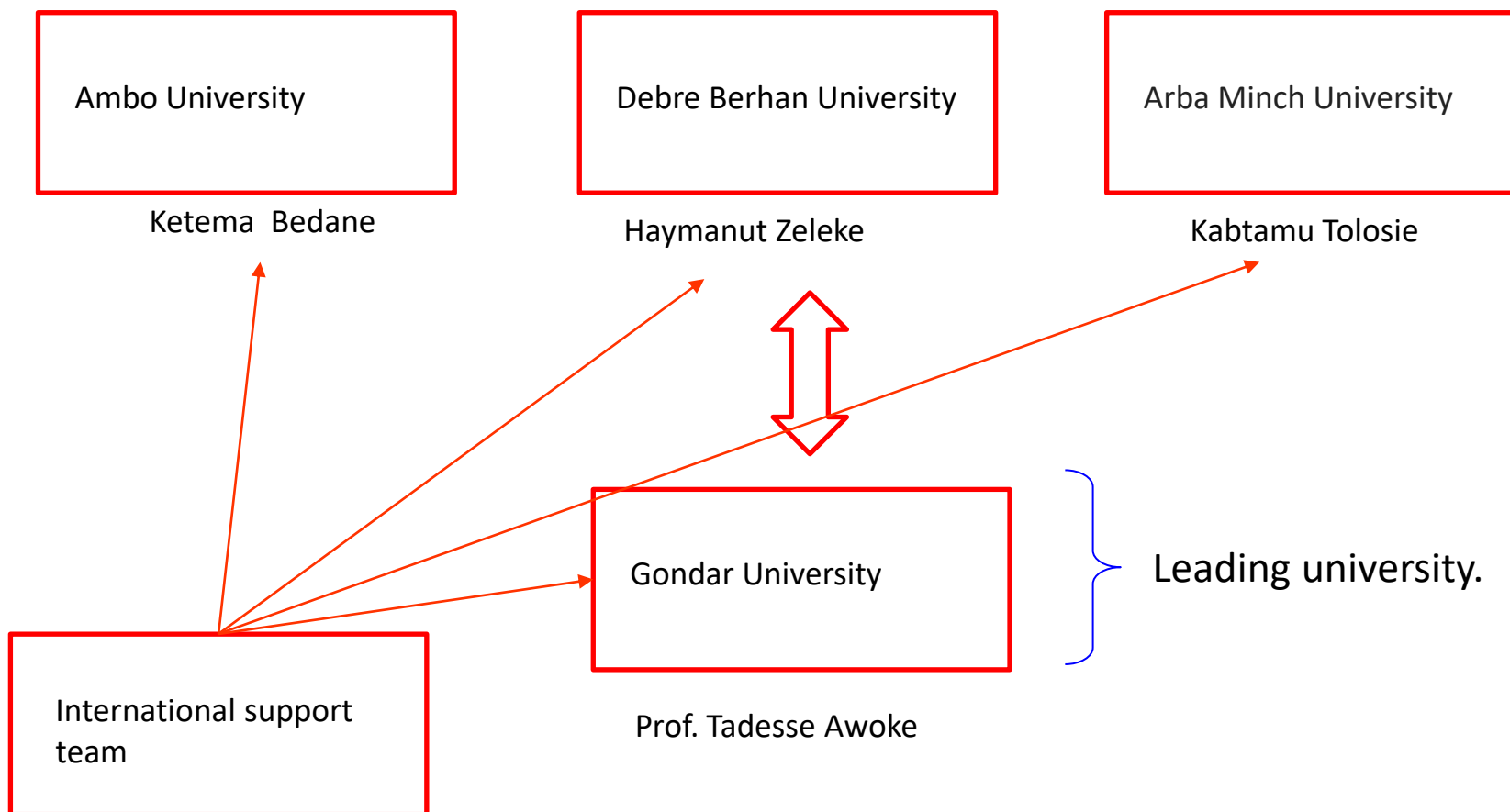


Collaborators network (Kenya)





Collaborators network (Ethiopia)





Collaborators network (South Africa)

University of
Zululand

Prof. Peter Njuho.

Stellenbosch
University

Prof. Peter Nyasulu

University of
Venda

Prof. Caston Sigauke



Pretoria
University

Prof. Samuel Manda

WITS
University

Prof. Tobias Chirwa

MRC
University

Prof. Tarylee Reddy

Leading
universities &
institutes.

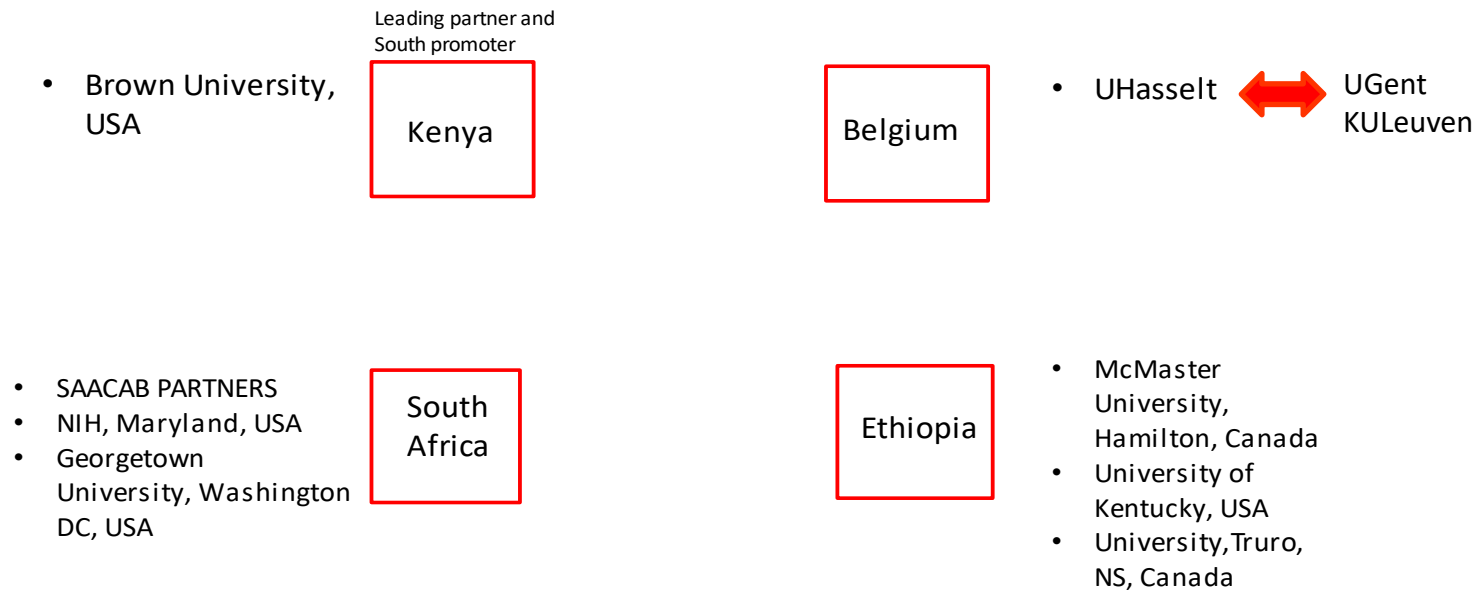
SSACAB,
SUSAN,
International
...





Collaborators network 1 (International)

- Existing collaboration links among partners:





Collaborators (SSACAB, Gambia workshop, DS paper etc.)

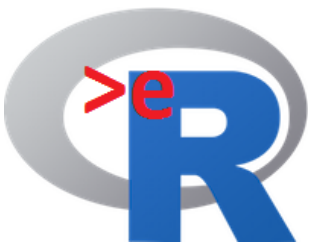
- USA:
 - Misrak Gezmu, Statistician, NIAID, NIH, Maryland, USA.
 - Joseph Hogan, Brown University, Rhode Island, USA.
 - Mahlet Tadesse, Georgetown University, Washington DC, USA.
 - Solomon W. Harar, Department of Statistics, University of Kentucky, Lexington, Kentucky, USA.
 - Mekbib Altaye and Tesfaye B. Mersha, Cincinnati Children's Hospital Medical Center, University of Cincinnati, Cincinnati, OH, USA.
- Canada:
 - Joseph Beyne, Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, ON, Canada.
 - Tessema Astatkie, Faculty of Agriculture, Dalhousie University, Truro, NS, Canada.
- Others:
 -



The >eR-BioStat : example of one course
GLM

Our new website

<https://erbiostat.wixsite.com/erbiostat>



Example of the course: GLM

GLM:

- A part of the advanced courses.
- Developed at a class level (i.e.: can be given in class).

The screenshot shows a web browser displaying the Erbiostat website. The page title is "Our courses". It is divided into three columns: "Introductory", "Basic", and "Advanced".

Introductory

- Introduction to R
- Statistical modeling: Linear regression using R
- Statistical modeling: One-way ANOVA using R
- Statistical modeling: Logistic regression using R
- Vizualizing data using R: an introduction
- Basic concepts of statistical inference using R

Basic

- Basic concept in statistical inference using R (1)
- Basic concept in statistical inference using R (2)
- Linear Regression using R

Advanced

- Applied Generalized Linear Models (GLM) using R
- Modelling Binary Data using R
- Longitudinal data analysis (LDA) using R
- Linear models using R
- Survival Analysis using R
- An introduction to bootstrap using R
- Sample size calculation using R
- Exploratory multivariate data analysis using R
- Survival Analysis using R (A)

A red arrow points to the "Advanced" column. A "CHAT WITH US" button is visible in the bottom right corner of the website content.



Contact

Dobson & Barnett

her GLM1: iterations: 4





Course content + slides and R programs

- Open source:

- PDF.
- Power point.

both PowerPoint
and PDF formats.

• glm()

Part 1

The following chapters are covered in part 1:

- Analysis of Variance
- Linear regression models with normal error.
- Generalized linear models.
- Exponential Family
- Generalized linear model function in R
- Models for Binary data.
- Estimation and confidence intervals.
- Inference.
- Model Selection.
- Model diagnostic.



Part 1 (PDF)

Part 1 (PowerPoint)

R program for Chapter 1

R program for Chapter 2

R program for Chapter 3

R program for Chapter 6

R program for Chapter 7

R program for Chapter 8

Part 2

The second part of the course consists of the following chapters:

- Poisson Regression.
- Beyond Poisson and binomial distributions: models with different link functions and/or distributions.
- Poisson regression and log linear models.
- Over dispersion.

Part 2 (PDF)

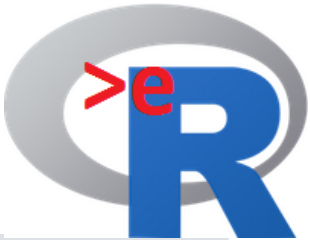
Part 2 (PowerPoint)

R program for Chapter 11

R program for Chapter 12

R program for Chapter 13

R program for Chapter 14



Online material

Materials include:

- Online books.
- Online tutorials (slides).
- Online tutorials in YouTube.

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ifferent topics in GLM analysis in R.

Online books/notes

University of Wisconsin	Daniel Johnson (2022)	Jonathan Rosenblatt (2019)
GLM in R (html)	GLM with example (html)	GLM (html)
Germán Rodríguez		
GLM (html)		

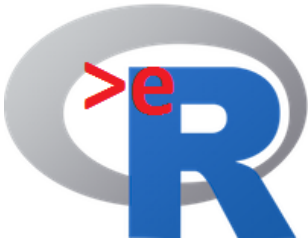
<http://www.john-ros.com/Rcourse/glm.html>

Online Tutorials

Notes (Geyer, 2003)	Notes (Everitt & Hothorn)	Slides (Turner 2008)
Generalized Linear Models in R (PDF)	GLM in R (PDF)	Introduction to GLM (PDF)

YouTubeTutorials

GLM in R	GLM in R	GLM in R
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Example of a chapter

(book of Jonathan D. Rosenblatt)

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Chapter 7 Generalized Linear Mo

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6.1 Problem Setup

6.2 OLS Estimation in R

6.3 Inference

6.4 Extra Diagnostics

6.5 Bibliographic Notes

6.6 Practice Yourself

7 Generalized Linear Models

7.1 Problem Setup

7.2 Logistic Regression

7.3 Poisson Regression

7.4 Extensions

7.5 Bibliographic Notes

7.6 Practice Yourself

8 Linear Mixed Models

8.1 Problem Setup

8.2 LMMs in R

8.3 Serial Correlations in Space/T...

8.4 Extensions

8.5 Bibliographic Notes

8.6 Practice Yourself

9 Multivariate Data Analysis

9.1 Signal Detection

9.2 Signal Counting

9.3 Signal Identification

9.4 Signal Estimation (*)

9.5 Bibliographic Notes

9.6 Practice Yourself

7.3 Poisson Regression

Poisson regression means we fit a model assuming $y|x \sim \text{Poisson}(\lambda(x))$. Put differently, we assume that for each treatment, encoded as a combinations of predictors x , the response is Poisson distributed with a rate that depends on the predictors.

The typical link function for Poisson regression is the logarithm: $g(t) = \log(t)$. This means that we assume $y|x \sim \text{Poisson}(\lambda(x) = e^{x\beta})$. Why is this a good choice? We again resort to the two-group case, encoded by $x = 1$ and $x = 0$, to understand this model: $\lambda(x = 1) = e^{\beta_0 + \beta_1} = e^{\beta_0} e^{\beta_1} = \lambda(x = 0) e^{\beta_1}$. We thus see that this link function implies that a change in x **multiplies** the rate of events by e^{β_1} .

For our example¹⁵ we inspect the number of infected high-school kids, as a function of the days since an outbreak.

```
cases <-  
structure(list(Days = c(1L, 2L, 3L, 3L, 4L, 4L, 4L, 6L, 7L, 8L,  
8L, 8L, 8L, 12L, 14L, 15L, 17L, 17L, 17L, 18L, 19L, 19L, 20L,  
23L, 23L, 23L, 24L, 24L, 25L, 26L, 27L, 28L, 29L, 34L, 36L, 36L,  
42L, 42L, 43L, 43L, 44L, 44L, 44L, 44L, 45L, 46L, 48L, 48L, 49L,  
49L, 53L, 53L, 53L, 54L, 55L, 56L, 56L, 58L, 60L, 63L, 65L, 67L,  
67L, 68L, 71L, 71L, 72L, 72L, 72L, 73L, 74L, 74L, 74L, 75L, 75L,  
80L, 81L, 81L, 81L, 81L, 88L, 88L, 90L, 93L, 93L, 94L, 95L, 95L,  
95L, 96L, 96L, 97L, 98L, 100L, 101L, 102L, 103L, 104L, 105L,  
106L, 107L, 108L, 109L, 110L, 111L, 112L, 113L, 114L, 115L),  
Students = c(6L, 8L, 12L, 9L, 3L, 3L, 11L, 5L, 7L, 3L, 8L,  
4L, 6L, 8L, 3L, 6L, 3L, 2L, 2L, 6L, 3L, 7L, 7L, 2L, 2L, 8L,  
3L, 6L, 5L, 7L, 6L, 4L, 4L, 3L, 3L, 5L, 3L, 3L, 3L, 5L, 3L,  
5L, 6L, 3L, 3L, 3L, 2L, 3L, 1L, 3L, 3L, 5L, 4L, 4L, 3L,  
5L, 4L, 3L, 5L, 3L, 4L, 2L, 3L, 3L, 1L, 3L, 2L, 5L, 4L, 3L,  
0L, 3L, 3L, 4L, 0L, 3L, 3L, 4L, 0L, 2L, 2L, 1L, 1L, 2L, 0L,  
2L, 1L, 1L, 0L, 0L, 1L, 1L, 2L, 2L, 1L, 1L, 1L, 0L, 0L,  
0L, 1L, 1L, 0L, 0L, 0L, 0L, 0L)), .Names = c("Days", "Students"))
```



R code for modeling

<http://www.john-ros.com/Rcourse/glm.html#poisson-regression>

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6.1 Problem Setup

6.2 OLS Estimation in R

6.3 Inference

6.4 Extra Diagnostics

6.5 Bibliographic Notes

6.6 Practice Yourself

7 Generalized Linear Models

7.1 Problem Setup

7.2 Logistic Regression

7.3 Poisson Regression

7.4 Extensions

7.5 Bibliographic Notes

7.6 Practice Yourself

8 Linear Mixed Models

8.1 Problem Setup

8.2 LMMs in R

8.3 Serial Correlations in Space/T...

8.4 Extensions

8.5 Bibliographic Notes

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9.6 Practice Yourself

- What is the sign of the effect of time on the number of sick students?
- Can we assume a linear effect of time?

```
plot(Days, Students, xlab = "DAYS", ylab = "STUDENTS", pch = 16)
```

We now fit a model to check for the change in the rate of events as a function of the days since the outbreak.

```
glm.3 <- glm(Students ~ Days, family = poisson)
summary(glm.3)
```

```
##
## Call:
## glm(formula = Students ~ Days, family = poisson)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -2.00482  -0.85719  -0.09331   0.63969   1.73696
##
## Coefficients:
```

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