

Hiroshi Suzuki

2023-02-28

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AI

2019

2019 9

2020

Data Analysis for Researchers

20

PDF ePub

PDF ePub

- PDF
- ePub

Chapter 1

R python
dio IDE integrated development environment, R R Stu-
Cloud Reproducibility Posit
ming R Markdown Literate Program-
Bookdown R Markdown bookdown
R

APPENDIX ??

variable object

Appendix A

MOOCs

2019 9 17

A.1 YouTube

PDF

A.2

A.2.1

A.2.1.1

A.2.1.1.1

- 5 :2016 1 22 ¹
– <https://www8.cao.go.jp/cstp/kihonkeikaku/index5.html>
 - :2016 12 21 -
 1. ()
 - 2.
 3.
<https://www8.cao.go.jp/cstp/kihonkeikaku/index5.html>
-

¹1 2

- (6)
 - (D-DRIVE²)2017 ~
 - - 20 :2019 1 8
 - http://www.mext.go.jp/b_menu/shingi/chousa/koutou/095/gaiyoku/1412367.htm
 - : 2019 3 26
 - https://www.meti.go.jp/shingikai/economy/risukei_jinzai/20190326_report.html
 - ()
 - AI :2019 3 29 <https://www8.cao.go.jp/cstp/aigensoku.pdf>
 - AI 2019 AI 2019 6 11 <https://www.kantei.go.jp/jp/singi/tougou-innovation/pdf/aisenryaku2019.pdf>
1. 1: (50 /) AI [MOOC]
 2. 2: (100 /) AI
 3. 3: (AI)

A.2.1.2

<http://www.mi.u-tokyo.ac.jp/consortium/index.html>

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A.2.1.3

- 2019

A.2.2

A.2.2.1 IR

IR IR

A.2.2.2

2019 3 MOOCs

²Doctoral program for Data-Related InnoVation Expert

A.2.2.3 : (Data Analysis for Researchers)

- () 3
- :Rotary Peace Fellow, The Project for Human Resource Development Scholarship (JDS) 4 10-25
- :
- :2 (70 × 2 × 10) 1 1
- : (R Markdown etc.)
- :2014-2015³, (2016), 2017

A.2.2.4

1. Introduction to R, Open Data and Free Software
2. Basic R Objects and Commands
2. Data Frame Manipulation
3. Linear Regression and Graphics
4. Dynamic Documents Using Rmarkdown
6. Statistical analysis with R II
5. Statistical analysis with R III
6. Statistical analysis with R IV
7. Guest Lecture and preparation for presentations
8. Final presentations

A.2.2.5

R Studio (PC) R R Markdown

- Base R
 - cars:
 - iris:
- package MASS
- WDI: World Bank Development indicators for R


```
library(WDI)
#GDP (current US$)
gdp <- WDI(country = c("US", "JP", "CN", "KR"),
  indicator = "NY.GDP.MKTP.CD",
  start = 1960, end = 2017)
```

 - wbstats
- Quandl package: <https://www.quandl.com/tools/r>
- Google Trends: <https://trends.google.co.jp/>
- Yahoo Finance: <https://finance.yahoo.com/quote/DATA/>

³2015

(Computing for Researchers)

A.2.3

A.2.3.1

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- ()

AI

A.2.3.1.1

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- ()

A.2.3.2 ()

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- ()

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— () ? ?
— () AI
— ()
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A.2.3.3

? Liberal Arts?

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A.2.3.4**Teaching to Learning**

- *
 – - () Community of Inquiry (CoI), - Com-
 munication of Facts

A.2.3.5**Students with Various Backgrounds**

- :
- ()

A.2.3.6 Literacy**Expand your horizon!**

- :
 –
 – Q & A ()
 –
- :
 – I, II, A, B - :
 –
- :
 –
 –

A.2.3.7 Resources**IT / Cloud**

- (Open/Public Data)
- (Online/Cloud)
- (Free and online/cloud system)

A.2.3.8 :

- 1.
- 2.
3. http://www.soumu.go.jp/menu_seisaku/ictseisaku/ictriyou/ope
 ndata/

A.2.3.9 World Bank: Open Data Defined

The term “Open Data” has a very precise meaning. Data or content is open if anyone is free to use, re-use or redistribute it, subject at most to measures that

preserve provenance and openness.

1. The data must be **legally open**, which means they must be placed in the public domain or under liberal terms of use with minimal restrictions.
2. The data must be **technically open**, which means they must be published in electronic formats that are machine readable and non-proprietary, so that anyone can access and use the data using common, freely available software tools. Data must also be publicly available and accessible on a public server, without password or firewall restrictions. To make Open Data easier to find, most organizations create and manage Open Data catalogs.

A.2.3.10

List of Open Data Catalogue

- [:https://www.data.go.jp](https://www.data.go.jp)
- :
 - 1.
 - 2.
 - 3.
 - [:https://www.data.go.jp/list-of-database/](https://www.data.go.jp/list-of-database/)
 - [:https://www.jma.go.jp/jma/menu/menureport.html](https://www.jma.go.jp/jma/menu/menureport.html)
- U.S. Government's Open Data: <https://www.data.gov>
- EU Open Data Portal: <http://data.europa.eu/euodp/en/home>
- UK Open Data: <https://data.gov.uk>
- World Bank: New Ways of Looking at Poverty
 - Open Data: <https://data.worldbank.org>
 - World Development Indicators: <http://datatopics.worldbank.org/world-development-indicators/>
- UN Data: <http://data.un.org>
- WHO Data: <https://www.who.int/gho/en/>
- Google Public Data: :7 :136 <https://www.google.com/publicdata/directory>
- Open Knowledge Foundation: <https://okfn.org>
 - Global Open Data Index: <https://index.okfn.org>

A.2.3.10.1 Free Software, Online Access R

- R Project for Statistical Computing: <https://www.r-project.org>
- R Studio: <https://www.rstudio.com>
- R Studio Cloud: <https://rstudio.cloud>

A.2.3.10.2 Python

- Python: <https://www.python.org>
- Anaconda: <https://www.anaconda.com>
- Jupyter Notebook Cloud: Binder, Kaggle Kernels, Google Collaborate, CoCalc, PaizaCloud, etc.

A.2.3.10.3 Free Software

- Free Software, Free Society: Selected Essays of Richard M. Stallman: <https://www.gnu.org/philosophy/fsfs/rms-essays.pdf>
- Richard Stallman TEDxGeneva 2014: https://youtu.be/Ag1AKII_2GM

A.2.3.10.4 Online Learning Source**List of Online Help and Mini Courses**

- Online
 - TutorialPoint: <https://www.tutorialspoint.com/>
 - DataCamp: <https://www.datacamp.com/home>
 - Code Academy: <https://www.codecademy.com>
 - RStudio Premier: <https://rstudio.cloud/learn/primers>
- User Community

A.2.3.10.5 MOOCs

- OED: MOOC n. massive open online course, an educational course made available to a large number of people via the internet.
- First MOOC: 2008 by Dave Cormier, Connectivism and Connective Knowledge (CCK08)
- MIT OpenCourseWare 2002: ()OER Stanford U Model: UC Berkeley:
- MOOC : 2012 Stanford U. MIT

A.2.4 Massive Open Online Courses (MOOCs)**Moocs****A.2.4.1 MOOCs ****

-
-
-
- (datasets) () *

A.2.4.2 MOOCs

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-
-
-

A.2.4.3 Moocs

A.2.4.3.1 Coursera Stanford U.

- Stanford U.: Machine Learning <https://www.coursera.org/learn/machine-learning>
- (:2,513,476)
- Johns Hopkins U.: Data Science, 10 courses [, R] <https://www.coursera.org/specializations/jhu-data-science>
- U. of Michigan: Applied Data Science, 5 courses [, python] <https://www.coursera.org/specializations/data-science-python>
- 100% U. of Illinois, U. of Michigan, U. of Colorado,

A.2.4.3.2 edX MIT Harvard U.

- Harvard U.: Data Science, 9 courses [, R]
- MIT: Statistics and Data Science, 5 courses [Graduate Level]
- <https://www.edx.org/micromasters/mitx-statistics-and-data-science>
- Microsoft, IBM, UC SanDiego

A.2.4.4 Professional Certificate in Data Science

A.2.4.4.1 : HarvardX, through edX

- URL: <https://online-learning.harvard.edu/series/professional-certificate-data-science>
- Book: <https://rafalab.github.io/dsbook/> (R Markdown Document)

A.2.4.4.2 R Data Camp Assessment

1. Data Science: R Basics; R
2. Data Science: Visualization;
3. Data Science: Probability;
4. Data Science: Inference and Modeling;
5. Data Science: Productivity Tools; Unix, Git, GitHub, R Markdown

- 6. Data Science: Wrangling;
- 7. Data Science: Linear Regression;
- 8. Data Science: Machine Learning;
- 9. Data Science: Capstone

A.2.4.4.3 Professional Certificate in Data Science

8 weeks 8 weeks 8 weeks 8 weeks 8 weeks 8 weeks 8 weeks 8 weeks 2 weeks
 Required R Packages for Examples: tidyverse, dslabs: <https://cran.r-project.org/web/packages/dslabs/dslabs.pdf>

-
- 2010 FBI
- Gapminder: Almost nobody knows the basic global facts! (Gapminder Test)
 - TED (Hans Rosling) <https://www.gapminder.org>
 - Health and income outcomes for 184 countries from 1960 to 2016
 - Country, Year, Infant deaths per 1000, Life expectancy in years, Average of children per woman, Country population, GDP, Continent, Geographical region
- Brexit
- 2016
- UC Berkeley
-
-

A.2.4.4.4 JMOOC MOOC

(1)

- Week 1
 -
 - - gacco:
- Week 2
 -
 - :
- Week 3
 - Excel, R, Python
- Week 4
 -
 - -
 -

A.2.4.4.5 JMOOC: [https:// www. jmooc. jp](https://www.jmooc.jp) 10 8

- II: ()

A.2.5

A.2.5.1

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-
-

A.2.5.2 R Markdown Or jupyter notebook for python

- Reproducible Research:
- Literate Programming: Code, Script * html, doc, presentation, pdf (using TeX)
-

A.2.5.3

-
-
-
- Empirical ([,])
-

Quote: On Listening to Lectures, by Plutarch The correct analogy for the mind is not a vessel that needs filling, but wood that needs igniting - no more - and then it motivates one towards originality and instills the desire for truth. (<https://quoteinvestigator.com/2013/03/28/mind-fire/>)

()

A.2.6

A.2.6.1

Quote: Apple co-founders Steve Jobs and Steve Wozniak didn't have degrees when they launched what has become one of the most valuable companies in the world. And now Apple CEO Tim Cook is

spreading the word that would-be programmers really don't need the endorsement of a university to be able to create something of commercial value, such as an app for the Apple App Store. <https://www.zdnet.com/article/apple-ceo-tim-cook-you-dont-need-a-degree-to-code-mobile-apps/>

A.2.6.2

AI

Appendix B

MOOCs

3 12 (II) covid-19

B.1

(AI [1] 2019 6 11 AI 2019 AI
2025
1. (50 /) AI [MOOC]
2. (100 /) AI
3. (AI)
6 25% 1500 AI (100
/)
AI [3] 2000 ² GP 6 3
2012 ⁴ [4] STEAM
1, 3 (AI)
AI AI

¹5 20 22 11 IT EXPO
²22000.6 ()
³3
⁴42012.8

B.2

AI AI 2019 AI

AI

AI (Artificial Intelligence()) AI

2019 AI AI AI

AI

([11])

(,) (Decision Science) (Empirical

Study) ()

AI

Google, Amazon, Netflix

(Recommendation System)

5

AI AI

([12])

AI

AI AI Artificial Gen-

eral Intelligence (AGI) AI

AI

B.3

B.3.1

5 ([7, 9])

(IoT,
Big Data)

(Public Data)

6

(R, Python)

edX, Coursera, JMOOC MOOCs

‘Skills and Self - ID Top Factors’

[13]

([8])

GAFA

B.3.2

TA

TA

2025 5

AI

()

R

Free

()

AI

Respect

B.3.3

()

()

1. Broad Band Internet Access
Broad Band Internet Access
2. RStudio (for R), Jupyter (for python) Data Science
Interactive Security
3. Team and Collaborative Teaching
4. MOOCs OCW
Interactive
5. Evidence Base AI Fact Base, Black Box
Fake News Hate Speech
Data Science

- A. Data Science: What? and Why?
 - Data Science ? AI ? Data Scientists?
 - Data Science ? -
- B. Business Data Science
- C. Data Science :Data Data
- D. Data Analysis

- [1] AI (AI) https://www.kantei.go.jp/jp/singi/ai_senryaku/index.html
- [2] AI 2019 AI 2019 6 11 <https://www.kantei.go.jp/jp/singi/tougou-innovation/pdf/aisenryaku2019.pdf>
- [3] AI https://www.kantei.go.jp/jp/singi/ai_senryaku/suuri_datascience_ai/dai1/sankou3.pdf
- [4] <https://www.mhlw.go.jp/toukei/learning/index.html>
- [5]
- [6] ~ Moocs (:)
- [7] AUTOMATE THIS: how algorithm came to rule our world by Christopher Steiner

- [8] Doing Data Science by Rachel Schutt and Cathy O’Neil
- [9] Weapon’s of Math Destruction by Cathy O’Neil AI
- [10] edX Professional Certificate in Data Science: <https://online-learning.harvard.edu/series/professional-certificate-data-science> edX Data Science Ethics: <https://www.edx.org/course/data-science-ethics>
- [11] Factfulness by Hans Rosling, et. al.
- [12] How I learned to understand the world by Hans Rosling with Fanny Haerges-tam
- [13] Analyzing the Analyzers (O’Reilly) by Harlan Harris, Sean Murphy, and Marck Vais- man

Appendix C

1
2020 3 2020 6

C.1 ? AI?

(Data Science) 10
AI(Artificial Intelligence)
(Decision Making Science)
2 7 (Training Data, 2 7)
2 7 () ()
Google, Amazon (Recommendation Sys-
tem)
([1, 2])
AI Buzz Word AI
() AI
AI
(Ex-
poratory Data Analysis)
(Data Visualization)
AI AI
([1],[4]²)

¹2019 3 31 ()College of Liberal Arts, International Christian University 2019
⁴ ¹
² “Weapons of Math Destruction” . (Weapons of Mass Destruction))

([8])

C.2

– 10 [5] ? Gapminder
 (<https://www.gapminder.org>) 13 10
 (bias) TED ([9]) Gapminder
 2017 Google Google Pub-
 lic Data (https://www.google.com/publicdata/directory?hl=en_US&5B
 Gapminder]) ([6])
 () e-Stat (<https://www.e-stat.go.jp>)³

C.3 ?

AI
 4
 5 Free-Open-Online⁶
 (Empirical)
 Excel R python⁷ (Reproducible)
 (Literate Programming)
 python R
 R RStudio IDE⁸
 RStudio.cloud
 RStudio.cloud <http://RStudio.cloud> Sign Up Google
 Project New Project RStudio
 Tools Install Packages ... swirl Console library(swirl)
 Enter() swirl() Enter R
<https://foods4all.github.io>
 RStudio.cloud Learn Cheat Sheets() Learn
 Primer() The Basic() RStudio.cloud Log
 Out

³ (specialized agencies)

⁴Gapminder Tools World Bank <https://data.worldbank.org>

⁵ AI : <https://dashboard.e-stat.go.jp>

⁶

⁷

⁷ Free Software Foundation <https://www.fsf.org/about/>

⁸Integrated Development Environment /

2 1 R ([3]) tidyverse
 R
 2 ([2])
 MOOCs (Massive Open Online Courses) JMOOC(<https://www.jmooc.jp>)
 HarvardX Data Science [7]
 9 2 9 (Audit) R
 (Script) Google
 MOOCs
<https://foods4all.github.io> Free-Open-Online

C.4

10

()

- [1] Christopher Steiner 2013.
- [2] Rachel Schutt, Cathy O’Neil 2014.
- [3] R Hadley Wickham 2017. “R for Data Science” (<https://r4ds.had.co.nz>) Jeffrey B. Arnold (<https://jrnold.github.io/r4ds-exercise-solutions/>)
- [4] AI Cathy O’Neil 2018 .
- [5] Factfulness()– 10 Hans Rosling BP 2019.
- [6] Hans Rosling 2019.
- [7] :edX Professional Certificate in Data Science: <https://online-learning.harvard.edu/series/professional-certificate-data-science>
- [8] :edX Data Science Ethics: <https://www.edx.org/course/data-science-ethics>
- [9] Hans Rosling TED Talk(): https://www.ted.com/talks/hans_rosling_the_best_stats_you_ve_ever_seen?language=ja

⁹Data Science: R Basics, Visualization
¹⁰ 2

Appendix D

Data Analysis for Researchers

D.1

International Christian University QALL401
2020

D.2

2021	Bookdown	2022	2021	Book-
down				
bookdown	R Markdown	R		
	2022	2023		12
<ul style="list-style-type: none">• Data Analysis for Researchers 2021• Data Analysis for Researchers 2022				

Appendix E

Introduction to R

E.1 70 x2

Data Analysis for Researchers D 2022 11 2 R
12 Data Analysis for Researchers

Data Analysis for Researchers Introduction

E.2

RMarkdown RNotebook [Code] RMarkdown
RStudio
• RNotebook

Appendix F

F.1

Data Analysis for Researchers D	2023 2 20 22 24	70
R	Web Google Colab R	
Windows R R Studio	Google Colab	
Public Data	World Development Indicator	
Template		
Windows R R Studio		Posit
Cloud RStudio Cloud 20 PC	Posit Cloud	

F.2

- R Studio R Slide + Vido
 - R Markdown
- R RNotebook
- RNotebook
 - WDI
 -

Appendix G

Data Science for All

searchers D F Data Analysis for Re-

G.1

- - Data Science for All -
- Let's enjoy data science together!
- 2019 2020

Appendix H

Chat GPT

Chat GPT

DeepL

H.1 Epidemiology -

2023.02.05

[HS] I want to know about the so-called digital health. For example, measuring the condition by the wearable device. Is there any academic research on the epidemiology using such devices?

[ChatGPT] Yes, there have been multiple studies and academic research done in the field of digital health, specifically regarding the use of wearable devices for monitoring health conditions. These studies have focused on a variety of topics such as the accuracy of wearable device readings, the potential for these devices to improve disease management and health outcomes, and the role of wearable devices in population health and epidemiology studies. For example, wearable devices have been used to monitor physical activity levels, heart rate, and sleep patterns, which can provide valuable insights into population health and disease trends. Additionally, wearable devices have been used to track the spread of infectious diseases and to monitor disease outbreaks, providing valuable information for public health decision-making.

[HS] Would you give a couple of examples with sources?

[ChatGPT] Certainly! Here are a few examples of academic studies related to digital health and wearable devices:

1. “Validation of Wearable Sensors for Continuous Monitoring of Physical Activity and Sleep” - This study, published in the Journal of Medical Internet Research in 2016, aimed to validate the accuracy of wearable devices for monitoring physical activity and sleep. The results showed that

wearable devices can provide reliable and valid measurements of physical activity and sleep patterns.

2. “The Potential of Wearable Devices in Chronic Disease Management: A Systematic Review” - This study, published in the Journal of Medical Systems in 2016, reviewed the literature on the use of wearable devices in the management of chronic diseases such as diabetes, heart disease, and respiratory disease. The results showed that wearable devices have the potential to improve disease management and health outcomes in these conditions.
3. “Using Wearable Devices to Track the Spread of Infectious Diseases” - This study, published in the Journal of Medical Internet Research in 2018, investigated the potential of wearable devices for tracking the spread of infectious diseases. The results showed that wearable devices can provide valuable data for disease surveillance and outbreak response.

These are just a few examples, but there are many more studies in the field of digital health and wearable devices. I hope this information is helpful!

[HS] Is there any discussion on regulations and moral standards for such privacy research?

[ChatGPT] Yes, there has been significant discussion and debate surrounding the regulations and ethical considerations for digital health research, particularly with regards to privacy. The use of wearable devices and other digital health technologies generates a large amount of personal data, which raises important privacy concerns.

For example, there are concerns about the security of personal health information and the potential for this information to be used for unauthorized purposes. There are also concerns about the potential for discrimination based on the information collected by wearable devices, such as discrimination in employment or insurance based on health status.

To address these concerns, there are a number of regulations and guidelines that have been developed to ensure the privacy and security of personal health information in digital health research. For example, the General Data Protection Regulation (GDPR) in the European Union and the Health Insurance Portability and Accountability Act (HIPAA) in the United States are two examples of privacy regulations that apply to digital health research.

In addition to these regulations, there are also ethical guidelines and codes of conduct for digital health research that outline the responsibilities of researchers and organizations in protecting the privacy and security of personal health information. For example, the World Medical Association has developed the Declaration of Helsinki, which provides ethical guidelines for medical research involving human subjects, and the Council for International Organizations of Medical Sciences has developed the International Ethical Guidelines for Health-Related Research Involving Humans, which provides similar guidelines for international health research.

Overall, the regulations and ethical considerations for digital health research are constantly evolving and it is important for researchers and organizations to stay up to date on the latest developments in this field to ensure that privacy and security are protected.

[HS] Can you give leading institutions planning to do such research worldwide?

[ChatGPT] There are many institutions and organizations around the world that are conducting research in the field of digital health and wearable devices. Here are a few examples of leading institutions in this field:

1. Harvard Medical School - Harvard Medical School is one of the leading institutions for digital health research, with multiple research groups and initiatives dedicated to studying the impact of wearable devices and other digital health technologies on health and wellness.
2. Stanford University - Stanford University has a strong tradition of innovation in digital health, and its School of Medicine has multiple research programs focused on wearable devices and other digital health technologies.
3. MIT Media Lab - The MIT Media Lab is a research lab at the Massachusetts Institute of Technology that focuses on interdisciplinary research at the intersection of technology and health. They have several research groups dedicated to digital health, including the Biomedical Cybernetics group, which focuses on the development of wearable devices and other digital health technologies.
4. Imperial College London - Imperial College London is a leading institution for research in digital health, with multiple research programs and initiatives focused on wearable devices and other digital health technologies.
5. University of California, San Francisco - The University of California, San Francisco is a leading institution for digital health research, with multiple research programs focused on the development and implementation of wearable devices and other digital health technologies.

These are just a few examples, and there are many other institutions and organizations around the world that are conducting research in the field of digital health and wearable devices.

[HS] Do you know institutions or examples conducting research in a local region but in an intensive way to promote health?

[ChatGPT] Yes, there are many institutions and organizations around the world that are conducting research on digital health and wearable devices with a focus on promoting health in a local region. Here are a few examples:

1. Kermanshah University of Medical Sciences, Iran - Kermanshah University of Medical Sciences has established a research center for digital health, which aims to promote health in the local region through the use of wearable devices and other digital health technologies. This center conducts research on a variety of topics related to digital health, including the de-

velopment of wearable devices for disease management and the evaluation of the impact of digital health interventions on health outcomes.

2. National University of Singapore, Singapore - The National University of Singapore has established a research program in digital health, which aims to promote health in the local region through the use of wearable devices and other digital health technologies. This program conducts research on a variety of topics related to digital health, including the development of wearable devices for disease management and the evaluation of the impact of digital health interventions on health outcomes.
3. University of the Witwatersrand, South Africa - The University of the Witwatersrand has established a research program in digital health, which aims to promote health in the local region through the use of wearable devices and other digital health technologies. This program conducts research on a variety of topics related to digital health, including the development of wearable devices for disease management and the evaluation of the impact of digital health interventions on health outcomes.

These are just a few examples, and there are many other institutions and organizations around the world that are conducting research in the field of digital health and wearable devices with a focus on promoting health in a local region.

[HS] What do you predict the future of epidemiology in connection with this digital health or research using IT devices such as wearable devices monitoring health?

[ChatGPT] The use of wearable devices and other digital health technologies has the potential to revolutionize epidemiology and the study of disease and health outcomes. Here are a few ways that digital health and wearable devices may shape the future of epidemiology:

1. Increased Data Collection: Wearable devices and other digital health technologies generate a large amount of data on individuals' health and behaviors, which can be used to better understand patterns of disease and health outcomes. This increased data collection has the potential to greatly enhance our understanding of the causes of disease and the factors that influence health outcomes.
2. Real-Time Monitoring: Wearable devices allow for real-time monitoring of individuals' health, which has the potential to greatly improve our ability to detect outbreaks of disease and track the spread of illness. This real-time monitoring has the potential to greatly enhance our ability to respond to public health emergencies and reduce the spread of disease.
3. Improved Data Analysis: With the increased data collection made possible by wearable devices and other digital health technologies, there will be a growing need for advanced data analysis methods and tools to make sense of this data. This will require new and innovative approaches to data analysis, including the use of machine learning and artificial intelligence.
4. Personalized Medicine: The data generated by wearable devices and other digital health technologies has the potential to inform the development

of personalized medicine, where treatments are tailored to an individual's specific needs and health status. This has the potential to greatly improve health outcomes and reduce the risk of adverse events associated with treatments.

Overall, the future of epidemiology in connection with digital health and wearable devices is very promising, with the potential to greatly enhance our understanding of disease and improve health outcomes. However, it is important to ensure that the privacy and security of personal health information are protected as we move forward with this research.

[HS] Thank you very much. I want to come back to you after reviewing your comments.

[ChatGPT] You're welcome! I'm here to help, so feel free to reach out to me again if you have any additional questions. Have a great day!

DeepL Translation

[HS]

[ChatGPT]

[HS]

[ChatGPT]

1. "Validation of Wearable Sensors for Continuous Monitoring of Physical Activity and Sleep" - 2016 Journal of Medical Internet Research
2. "The Potential of Wearable Devices in Chronic Disease Management" A Systematic Review" - 2016 Journal of Medical Systems
3. "Using Wearable Devices to Track the Spread of Infectious Diseases" - 2018 Journal of Medical Internet Research

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GDPR

HIPAA

[HS]

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1. - 1

2. -
3. MIT - MIT Biomedical
Cybernetics
4. Imperial College London - Imperial College London
5. -

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1. -
2. -
3. -

[HS] IT

[ChatGPT]

1. 1.
- 2.
3. 3.
- 4.

[HS]

[ChatGPT]

www.DeepL.com/Translator

Appendix I

Bookdown

I.1 About

This is a *sample* book written in **Markdown**. You can use anything that Pandoc’s Markdown supports; for example, a math equation $a^2 + b^2 = c^2$.

I.1.1 Usage

Each **bookdown** chapter is an .Rmd file, and each .Rmd file can contain one (and only one) chapter. A chapter *must* start with a first-level heading: **# A good chapter**, and can contain one (and only one) first-level heading.

Use second-level and higher headings within chapters like: **## A short section** or **### An even shorter section**.

The **index.Rmd** file is required, and is also your first book chapter. It will be the homepage when you render the book.

I.1.2 Render book

You can render the HTML version of this example book without changing anything:

1. Find the **Build** pane in the RStudio IDE, and
2. Click on **Build Book**, then select your output format, or select “All formats” if you’d like to use multiple formats from the same book source files.

Or build the book from the R console:

```
bookdown::render_book()
```

To render this example to PDF as a `bookdown::pdf_book`, you'll need to install XeLaTeX. You are recommended to install TinyTeX (which includes XeLaTeX): <https://yihui.org/tinytex/>.

I.1.3 Preview book

As you work, you may start a local server to live preview this HTML book. This preview will update as you edit the book when you save individual `.Rmd` files. You can start the server in a work session by using the RStudio add-in “Preview book”, or from the R console:

```
bookdown::serve_book()
```

I.2 Hello bookdown

All chapters start with a first-level heading followed by your chapter title, like the line above. There should be only one first-level heading (`#`) per `.Rmd` file.

I.2.1 A section

All chapter sections start with a second-level (`##`) or higher heading followed by your section title, like the sections above and below here. You can have as many as you want within a chapter.

An unnumbered section

Chapters and sections are numbered by default. To un-number a heading, add a `{.unnumbered}` or the shorter `{-}` at the end of the heading, like in this section.

I.3 Cross-references

Cross-references make it easier for your readers to find and link to elements in your book.

I.3.1 Chapters and sub-chapters

There are two steps to cross-reference any heading:

1. Label the heading: `# Hello world {#nice-label}`.
 - Leave the label off if you like the automated heading generated based on your heading title: for example, `# Hello world = # Hello world {#hello-world}`.
 - To label an un-numbered heading, use: `# Hello world {-#nice-label}` or `{# Hello world .unnumbered}`.
2. Next, reference the labeled heading anywhere in the text using `\@ref(nice-label)`; for example, please see Chapter I.3.

- If you prefer text as the link instead of a numbered reference use: any text you want can go here.

I.3.2 Captioned figures and tables

Figures and tables *with captions* can also be cross-referenced from elsewhere in your book using `\@ref(fig:chunk-label)` and `\@ref(tab:chunk-label)`, respectively.

See Figure I.1.

```
par(mar = c(4, 4, .1, .1))
plot(pressure, type = 'b', pch = 19)
```

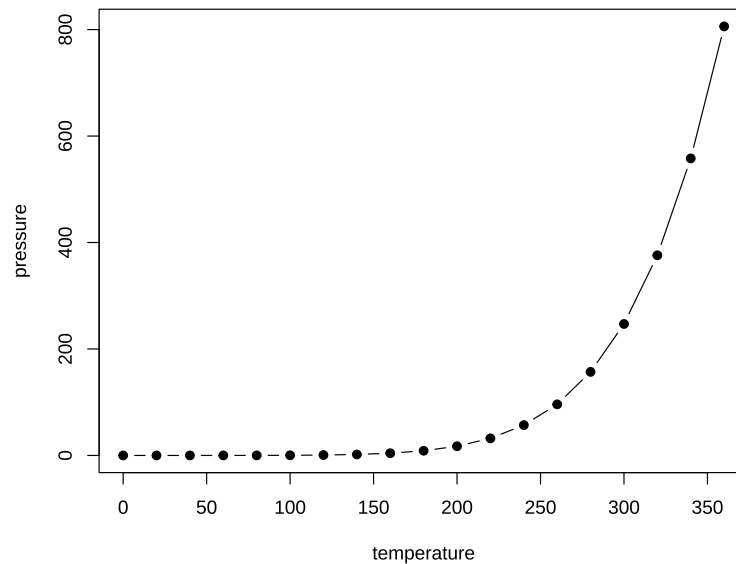


Figure I.1: Here is a nice figure!

Don't miss Table I.1.

```
knitr::kable(
  head(pressure, 10), caption = 'Here is a nice table!',
  booktabs = TRUE
)
```

I.4 Parts

You can add parts to organize one or more book chapters together. Parts can be inserted at the top of an .Rmd file, before the first-level chapter heading in that same file.

Table I.1: Here is a nice table!

temperature	pressure
0	0.0002
20	0.0012
40	0.0060
60	0.0300
80	0.0900
100	0.2700
120	0.7500
140	1.8500
160	4.2000
180	8.8000

Add a numbered part: `# (PART) Act one {-}` (followed by `# A chapter`)

Add an unnumbered part: `# (PART*) Act one {-}` (followed by `# A chapter`)

Add an appendix as a special kind of un-numbered part: `# (APPENDIX) Other stuff {-}` (followed by `# A chapter`). Chapters in an appendix are prepended with letters instead of numbers.

I.5 Footnotes and citations

I.5.1 Footnotes

Footnotes are put inside the square brackets after a caret `^[]`. Like this one ¹.

I.5.2 Citations

Reference items in your bibliography file(s) using `@key`.

For example, we are using the **bookdown** package (Xie, 2023) (check out the last code chunk in `index.Rmd` to see how this citation key was added) in this sample book, which was built on top of R Markdown and **knitr** (Xie, 2015) (this citation was added manually in an external file `book.bib`). Note that the `.bib` files need to be listed in the `index.Rmd` with the YAML `bibliography` key.

The `bs4_book` theme makes footnotes appear inline when you click on them. In this example book, we added `cs1: chicago-fullnote-bibliography.cs1` to the `index.Rmd` YAML, and include the `.cs1` file. To download a new style, we recommend: <https://www.zotero.org/styles/>

¹This is a footnote.

The RStudio Visual Markdown Editor can also make it easier to insert citations: <https://rstudio.github.io/visual-markdown-editing/#/citations>

I.6 Blocks

I.6.1 Equations

Here is an equation.

$$f(k) = \binom{n}{k} p^k (1-p)^{n-k} \quad (\text{I.1})$$

You may refer to using `\@ref{eq:binom}`, like see Equation (I.1).

I.6.2 Theorems and proofs

Labeled theorems can be referenced in text using `\@ref{thm:tri}`, for example, check out this smart theorem I.1.

Theorem I.1. *For a right triangle, if c denotes the length of the hypotenuse and a and b denote the lengths of the **other** two sides, we have*

$$a^2 + b^2 = c^2$$

Read more here <https://bookdown.org/yihui/bookdown/markdown-extensions-by-bookdown.html>.

I.6.3 Callout blocks

The `bs4_book` theme also includes special callout blocks, like this `.rmdnote`.

You can use **markdown** inside a block.

```
head(beaver1, n = 5)
#>   day time  temp activ
#> 1 346  840 36.33     0
#> 2 346  850 36.34     0
#> 3 346  900 36.35     0
#> 4 346  910 36.42     0
#> 5 346  920 36.55     0
```

It is up to the user to define the appearance of these blocks for LaTeX output.

You may also use: `.rmdcaution`, `.rmdimportant`, `.rmdtip`, or `.rmdwarning` as the block name.

The R Markdown Cookbook provides more help on how to use custom blocks to design your own callouts: <https://bookdown.org/yihui/rmarkdown-cookbook/custom-blocks.html>

I.7 Sharing your book

I.7.1 Publishing

HTML books can be published online, see: <https://bookdown.org/yihui/bookdown/publishing.html>

I.7.2 404 pages

By default, users will be directed to a 404 page if they try to access a webpage that cannot be found. If you'd like to customize your 404 page instead of using the default, you may add either a `_404.Rmd` or `_404.md` file to your project root and use code and/or Markdown syntax.

I.7.3 Metadata for sharing

Bookdown HTML books will provide HTML metadata for social sharing on platforms like Twitter, Facebook, and LinkedIn, using information you provide in the `index.Rmd` YAML. To setup, set the `url` for your book and the path to your `cover-image` file. Your book's `title` and `description` are also used.

This `bs4_book` provides enhanced metadata for social sharing, so that each chapter shared will have a unique description, auto-generated based on the content.

Specify your book's source repository on GitHub as the `repo` in the `_output.yml` file, which allows users to view each chapter's source file or suggest an edit. Read more about the features of this output format here:

https://pkgs.rstudio.com/bookdown/reference/bs4_book.html

Or use:

```
?bookdown::bs4_book
```

Bibliography

Xie, Y. (2015). *Dynamic Documents with R and knitr*. Chapman and Hall/CRC, Boca Raton, Florida, 2nd edition. ISBN 978-1498716963.

Xie, Y. (2023). *bookdown: Authoring Books and Technical Documents with R Markdown*. R package version 0.32.