

Assessing Backyard Poultry Versus Small Animal Knowledge of Veterinary Students Regarding Husbandry, Prescription Drug Use, and Antimicrobial Resistance

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ABSTRACT

As backyard poultry (BYP) ownership has increased in the US, the demand for veterinarians who treat BYP has also increased. However, veterinarians who treat BYP remain scarce and are mostly small animal veterinarians and exotic animal practitioners who have limited training in food animal regulatory practices. To gauge whether veterinary students are interested in learning more about BYP and what BYP topics to include in an online training program for veterinary students, a BYP knowledge assessment was conducted. Pre-clinical veterinary students were asked to self-rate their level of knowledge on various topics for both small animal practice and BYP using Likert-type ordinal scales. Wilcoxon signed-rank tests of those Likert data showed significant differences ($p < .01$ at $\alpha = .05$) between self-assessed knowledge of poultry and small animal medicine for all surveyed topics. Specifically, veterinary students ranked themselves as less knowledgeable on poultry concepts than on small animal medicine concepts. Nevertheless, students expressed interest in an online training program for treating BYP and drug residue avoidance in BYP, despite having chosen future career tracks that are not exclusively poultry. Specific topics students expressed interest in with respect to BYP training included anatomy, husbandry, prescribing medications, treatment options, food safety, antimicrobial resistance, and extra-label drug use.

Key words: veterinary students, knowledge assessment, backyard poultry

INTRODUCTION

Backyard poultry (BYP) ownership and egg consumption from BYP have substantially increased in the US.^{1,2} At the same time, concerns for public health, food safety, and avian health associated with BYP have been noted,^{3,4} while poultry curricula taught by veterinary schools is limited.⁵ From a food safety perspective, the Food Animal Residue Avoidance Databank Program reports that inquiries for withdrawal intervals following extra-label drug use BYP are some of the predominant types of questions submitted. In addition, public health could be compromised because of poor hygienic and husbandry practices such as not washing hands after handling live birds,⁴ thus increasing the chances of acquiring a salmonella infection.⁶ Furthermore, poor bio-security practices in combination with unregulated bird movement can facilitate the spread of disease between backyard and commercial flocks. For instance, the 2002 virulent Newcastle disease (vND) outbreak in Southern California originated in backyard poultry flocks^{7,8} and moved into commercial flocks, resulting in the depopulation of over 3 million birds and costing about \$161 million in economic losses.⁹ Additionally, the presence of lead in eggs from the inadvertent consumption of lead by BYP¹⁰ is an example of a nonorganic public health and food safety concern not addressed by current curricula.

Limited extension-based educational outreach and resources are available to BYP owners, which has made it difficult to disseminate reliable, science-based information⁹ and to encourage these owners to use veterinary services. Moreover, veterinarians willing to treat BYP can be difficult to find^{9,11} due to lack of interest and/or experience.¹¹ However, even when owners have access to a veterinarian who treats backyard poultry, owners may still

decide to forgo veterinary care.^{11,12} In a survey administered to backyard and small-scale livestock owners in the western US, only 42.7% (148/351) of owners reported seeking veterinary care when they had an animal health concern in the past year.¹¹ While veterinarians are regarded as an important source of information to BYP owners,⁸ especially in terms of infectious and parasitic diseases,¹¹ reasons identified in the survey to forgo veterinary care included not needing a veterinarian to solve the problem, cost, animal dying/culling, and difficulty finding a veterinarian for the species in question.¹¹

Compounding this lack of veterinary care for BYP, poultry training programs in veterinary colleges are diminishing in North America, with only 10 active programs reported in a 2006 publication.⁵ In the past, post-DVM poultry training programs helped prevent a shortage of poultry specialists from occurring at the commercial level.⁵ However, now that urban BYP ownership is on the rise, the demand for veterinarians who treat BYP has increased¹³ and ultimately requires a different type of training. These veterinarians not only need to know how to treat flocks and individual BYP, but they also need to be knowledgeable about rules and regulations associated with treating animals that produce food products destined for human consumption. In addition, the demand for veterinarians willing to treat poultry may increase even more now that the US Food and Drug Administration (FDA) Veterinary Feed Directive is fully implemented since medicated feeds used to treat poultry require a veterinarian's involvement.^{11,14} With respect to veterinary poultry curricula, education associated with the appropriate administration and prescribing of antimicrobials for BYP to reduce antimicrobial resistance (AMR) is still largely lacking. Consequently, robust training programs

for future poultry, small animal, and food animal veterinarians that plan to treat BYP are essential for public health, food safety, and animal welfare and health. To gauge whether veterinary students training in the US are interested in learning more about BYP and what BYP topics to include in an online training program for veterinary students, a BYP knowledge assessment was conducted by surveying veterinary students in their pre-clinical years.

METHODS

Study Sample

The target population for the survey were third-year veterinary students from accredited US universities with veterinary medicine colleges or schools. Third-year veterinary students were surveyed in order to assess the knowledge of pre-clinical students who have completed most of the veterinary school curriculum.

Survey

An online survey with a total of 17 questions was built with Qualtrics XM.^a Basic information about veterinary students was collected (Table 1 and Online-Only Appendix) before assessing students' knowledge on various topics related to BYP and small animal medicine. Specifically, using a Likert-type ordinal scale from 1 to 5 (1 = *not knowledgeable at all*, 5 = *extremely knowledgeable*), participants were asked to rank their level of knowledge for husbandry, anatomy, medical treatment options, and prescribing medications for both small animals and BYP. Small animal and BYP questions were paired to compare the student's knowledge on BYP with their knowledge on small animal patients. Participants were also asked to rank their level of knowledge, using a Likert-type ordinal scale (1 = *not knowledgeable at all*, 5 = *extremely knowledgeable*), on food safety, extra-label drug use, and AMR with respect to poultry. Additionally, via an open-ended question, participants were asked to list resources for drug residue avoidance for BYP. Last, to gauge whether an online course would be useful, participants were asked using a Likert-type ordinal scale how likely they were to take a free online course on backyard poultry (1 = *not likely*, 4 = *definitely*). The complete survey is available in the Online-Only Appendix.

The American Association of Veterinary Medical Colleges (AAVMC) distributed and opened the survey to the American Veterinary Medical Association in May 2019; the survey was closed in October 2019. Participation in the survey was voluntary and entirely completed online. The Institutional Review Board at the University of California, Davis declared the study as exempt (IRB ID 1424874-1).

Data Management and Analysis

No identifying information about the survey participants was collected. Survey responses were exported from Qualtrics XM. Frequencies and percentages for the general information questions (e.g., Which veterinary school do you attend?) were summarized in a spreadsheet (Microsoft Excel^b). Results from the open-ended question "What resources do you use or know of when information on drug residue avoidance for BYP is needed?" were diverse, so only responses that mentioned the Food Animal Residue Avoidance Databank (FARAD), the Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA), and the FDA are summarized. Results from the Likert-type ordinal scale questionnaire sections were analyzed and visualized with

Table 1: Survey responses, frequencies, and percentages for questions 1 ($n = 247$), 2 ($n = 247$), 3 ($n = 164$), 4 ($n = 238$), 16 ($n = 166$), and 17 ($n = 224$) in a survey evaluating veterinary students' knowledge about backyard poultry

Question	Response	Count (%)
1. Which veterinary school do you attend?	Auburn University	18 (7.3)
	Iowa State University	34 (13.8)
	Lincoln Memorial University	28 (11.3)
	North Carolina State University	22 (8.9)
	Ohio State University	20 (8.1)
	St. George's University	1 (0.4)
	Texas A&M University	22 (8.9)
	University of Georgia	5 (2.0)
	University of Missouri—Columbia	14 (5.7)
	University of Tennessee	16 (6.5)
	University of Wisconsin—Madison	29 (11.7)
2. What year are you graduating?	Washington State University	32 (13)
	Western College of Veterinary Medicine, University of Saskatchewan	6 (2.4)
	2017	1 (0.4)
	2019	6 (2.4)
	2020	118 (47.8)
3. What is your track?*	2021	121 (49.0)
	2023	1 (0.4)
3. What is your track?*	Small animal—exclusive	40 (24.4)
	Poultry-exclusive	1 (0.6%)
4. Do you plan on treating some backyard poultry as part of your future veterinary practice?	Yes	120 (50.4)
	No	118 (49.6)
16. What resources do you use or are aware of when you need information on drug residue avoidance for backyard poultry?*	FARAD	96 (57.8)
	AMDUCA	12 (7.2)
	FDA	15 (9.0)
17. If a free online course on treating backyard poultry and drug residue avoidance was available, how likely are you take it?	Not likely	12 (5.4)
	Maybe	80 (35.7)
	Most likely	73 (32.6)
	Definitely	59 (26.3)

FARAD = Food Animal Residue Avoidance Databank; AMDUCA = Animal Medicinal Drug Use Clarification Act of 1994; FDA = US Food and Drug Administration

* Questions 3 and 16 resulted in diverse responses; therefore, only responses indicating small animal- and poultry-exclusive tracks (question 3) and responses that mentioned FARAD, AMDUCA, and FDA (question 16) are summarized, respectively.

R 3.6.2^c and R Studio 1.2.5033^d using the Likert package¹⁵ from a CSV file.

The interpretation of means and standard deviations was unclear for the ordinal data¹⁶; therefore, the Likert-type scale data were visualized using diverging stacked bar charts.¹⁷ Moreover, a Wilcoxon signed-rank test ($\alpha = .05$) was performed on the paired backyard poultry and small animal responses for the husbandry, anatomy, prescribing medications, and medical treatment questions.¹⁵

RESULTS

Participants

In total, there were 247 survey participants from 13 institutions. A total of 75 surveys were completed and 172 were partially completed. Since each veterinary school distributed the survey at its discretion, the total number of survey invitations is not known. Therefore, a response rate is not reported here.

General Questions

Based on results from question 1 ($n = 247$), most of the respondents were from the US ($n = 240$), with only one student coming from St. George's University in the West Indies and six students coming from the University of Saskatchewan in Canada (Table 1). While the survey was targeted at third-year veterinary students, students from other class standings responded. Nonetheless, 47.8% (118/247) of the students indicated they were graduating in 2020 (i.e., third-year veterinary students) at the time of the survey as indicated by question 2 results (Table 1). Question 3 resulted in numerous combinations of responses due to students indicating they were participating in more than one career track (data not shown). Since one part of the study focuses on comparing small animal versus BYP knowledge, only responses indicating small animal-exclusive and poultry-exclusive tracks are reported in Table 1. Out of 164 respondents, 40 students (24.4%) indicated they were small animal-exclusive, and one student (0.6%) indicated they were poultry medicine-exclusive (Table 1). About half of the students indicated they planned on treating BYP as part of their future veterinary practice, with 49.6% (118/238) saying *no* (Table 1, question 4). Since question 16 was open-ended, the responses were diverse. As mentioned previously, for the purposes of this study, only responses that mentioned FARAD, AMDUCA, and FDA are summarized (question 16). Of the student respondents, 57.8% (96/166) mentioned FARAD as a resource they use or are aware of when information on drug residue avoidance for BYP is needed (Table 1). Fewer students mentioned AMDUCA—7.2% (12/166)—and FDA—9% (15/166). When asked how likely they would be to take a free online course on treating BYP and drug residue avoidance, most students showed interest, with 26.3% (59/224) responding *definitely* and 32.6% (73/224) saying *most likely* (Table 1).

Knowledge Assessment Questions

Wilcoxon signed-rank test results suggest that the distribution of responses was significantly different ($p < .01$ at $\alpha = .05$) between poultry and small animal ratings for all concepts. Figure 1 depicts the self-assessed ratings for the paired data. Based on the results, veterinary students felt more knowledgeable about anatomy, husbandry, prescribing medications, and medical treatment options for small animals than about BYP (Figure 1). Figure 2 depicts the self-assessed ratings for level of knowledge for food

safety, AMR, and extra-label drug use for BYP. The percentages that indicate *very* and *extremely knowledgeable* shown on the right tended to be lower than the percentages that indicate *not knowledgeable* and *slightly knowledgeable* on the left (Figure 2). The percentages of respondents who ranked themselves as *moderately knowledgeable* (neither *very knowledgeable* nor *not knowledgeable*) are depicted in gray.

DISCUSSION

The results from this study highlight a significant disparity in self-assessed veterinary student knowledge between small animal and poultry medicine. This finding is not surprising given the current state of veterinary curricula in the US, where poultry programs are largely regionalized based on proximity to the commercial poultry industry.⁵ The gradual loss of training and resources for DVM students interested in poultry medicine, originally described by Glisson and Hofacre,⁵ further describes the consequences or knock-on effects of regional contraction such as the loss of poultry-associated faculty and hence training opportunities for veterinary students interested in poultry medicine. Interestingly, this type of specialization was identified as a desirable approach toward creating a responsive and flexible veterinary medical education that would offer specialized education at specific veterinary schools with the goal of creating a national approach for educating veterinary students interested in different specialties.¹⁸ However, as BYP ownership continues to increase in popularity in the US,¹ it may be prudent for veterinary schools, even those in noncommercial poultry-producing regions, to begin to address this issue and start offering curricula to veterinary students interested in small animal or food animal practice. To that point, 50.4% (120/238) of veterinary students indicated they planned on having BYP as patients, but those students will most likely not be equipped with the knowledge base to be able to competently practice and will have to seek post-graduate training. This prediction is supported by our findings that 44% of students ranked themselves as *not knowledgeable* or *slightly knowledgeable* in poultry anatomy, 58% rated themselves as *not knowledgeable* or *slightly knowledgeable* on AMR related to BYP, and 64% rated themselves as *not knowledgeable* or *slightly knowledgeable* on extra-label drug use related to BYP.

With respect to regulations, the lack of poultry curricula appears to affect the students' self-reported knowledge regarding AMR, extra-label drug use, and food safety. Published literature outside the US has shown that veterinary students were largely unaware of the importance of antimicrobial use stewardship principles.^{19–22} Interestingly, in the US, there is a lack of literature on this topic. Although US students rated themselves as not very knowledgeable on regulatory and AMR concepts, about 57.8% of students had used or were aware of FARAD, an important program that provides veterinarians with guidance on drug residue avoidance following extra-label drug use.

Students showing interest in learning more about BYP was encouraging and highlights the importance of offering educational opportunities prior to graduation from veterinary school. Only 5.4% (12/224) of students indicated not being likely to take a free online course on treating BYP and drug residue avoidance if such training became available. Due to the nature of the survey, the basis for students' lack of interest is unknown. However, based on the percentages of students who were most likely or

How knowledgeable are veterinary students in small animal and poultry concepts?

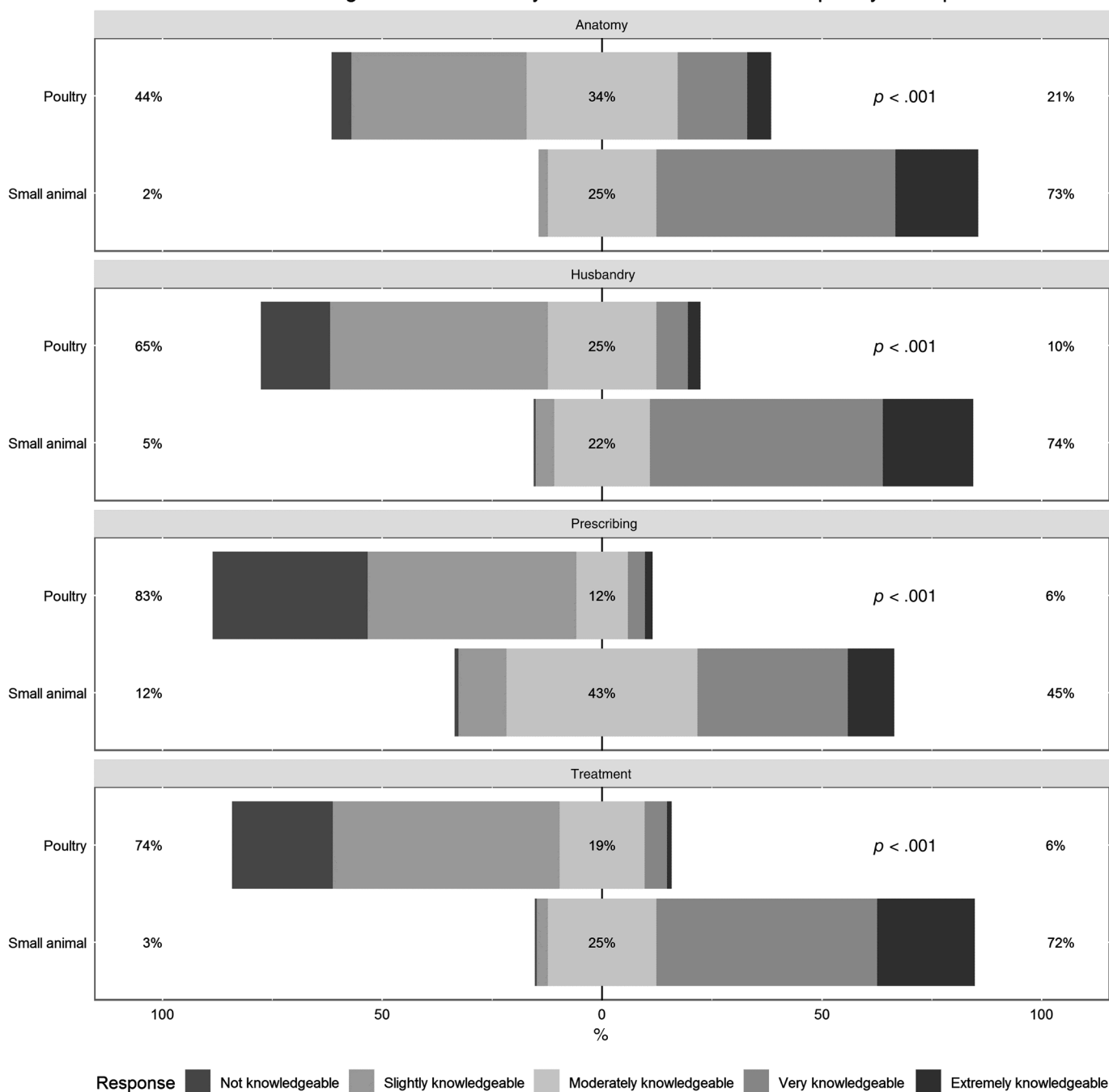


Figure 1: Veterinary students' self-assessment on knowledge of anatomy, husbandry, prescribing medications, and medical treatment options for both backyard poultry and small animals

definitely interested in educational opportunities, greater pre-clinical and clinical education in AMR, AMR-based stewardship, and extra-label drug use would be beneficial.

Compared with that in many other countries, curricula and training of veterinary students in the US is substantially more focused on small animal practice than on food animal medicine, food safety, and public health.²³ In order to protect public health, educating veterinary students is essential, especially for a BYP sector that is not inspected or regulated.

Limitations

One limitation of the study is that only 11 US accredited colleges of veterinary medicine out of 30 were represented, making it difficult to generalize results. Nevertheless, this study is a first structured step in understanding veterinary students' interest in and knowledge of BYP. Another limitation is the subjective nature of Likert-type scales. However, while the self-assessed knowledge ratings may not truly reflect the student respondents' level of knowledge, it would be difficult to conduct a less

How knowledgeable are veterinary students in regulatory and AMR concepts for poultry?

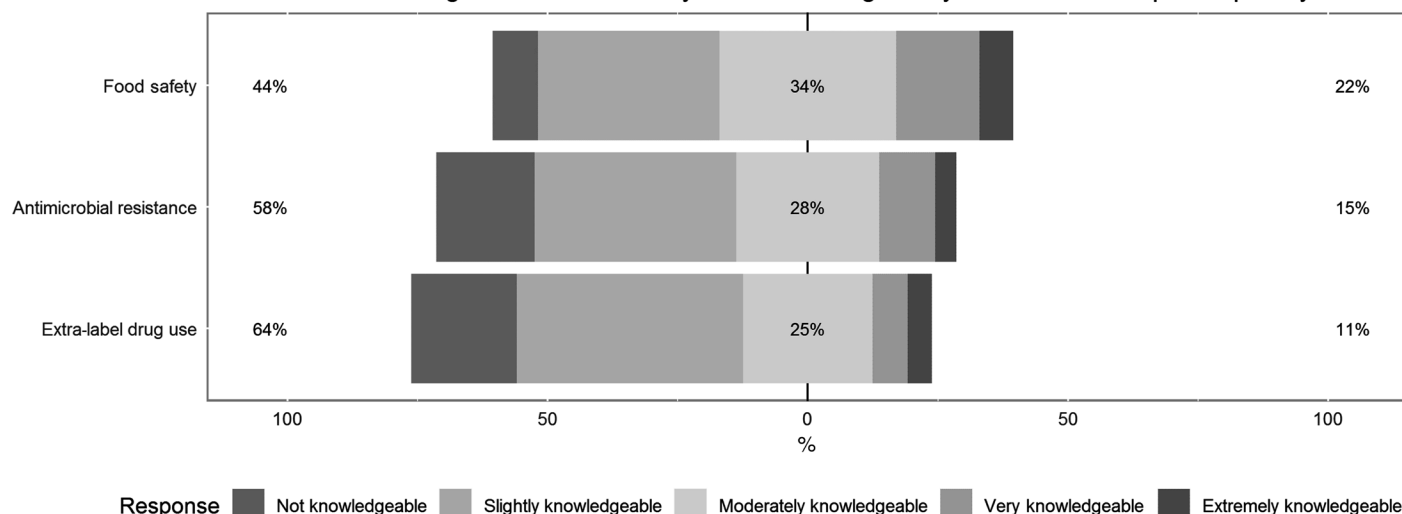


Figure 2: Veterinary students' self-assessment on knowledge of food safety, antimicrobial resistance (AMR), and extra-label drug use for backyard poultry

subjective test, such as a formal test, given that students from various schools and different tracks participated in the survey.

CONCLUSIONS

Results from this study suggest that US small animal veterinary students are in need of BYP resources and are interested in learning more about treating BYP and drug residue avoidance, despite having career tracks that are small animal focused. Poultry curricula that could be developed for online training modules include anatomy, husbandry, prescribing medication, treatment options, food safety, AMR, and extra-label drug use. To better prepare students for real-world practice, they could be given access to this poultry curricula. Such training could potentially help increase learning opportunities for veterinary students and increase medical services available to BYP clients.

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NOTES

- a Qualtrics XM, Provo, UT, USA, <https://www.qualtrics.com>.
- b Microsoft Excel, Redmond, WA, USA, <https://www.microsoft.com/en-us/microsoft-365/excel>.
- c R, Vienna, Austria, EU, <https://www.R-project.org>.
- d R Studio, Boston, MA, USA, <https://rstudio.com>.

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