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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებშიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman (Кириллица)**, для текста на грузинском языке следует использовать **AcadNusx**. Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи.** Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - <http://www.spinesurgery.ru/files/publish.pdf> и http://www.nlm.nih.gov/bsd/uniform_requirements.html. В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректур авторам не высылаются, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or computer-printed on a single side of standard typing paper, with the left margin of 3 centimeters width, and 1.5 spacing between the lines, typeface - **Times New Roman (Cyrillic)**, print size - 12 (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf

In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned
Requirements are not Assigned to be Reviewed.**

ავტორთა საყურადღებო!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე, დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx**. შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემავსებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრაფიის ფოტოსურათები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგების ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფხიხლებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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DUAL-SOFTWARE INTEGRATION IN MEDICAL STATISTICS TEACHING: A CASE-BASED APPROACH TO F-DISTRIBUTION WITH DOUBAO AI AND R

Ling-Ling Zhou, Lian-Ping He.

School of Medicine, Taizhou University, Jiaojiang, 318000 Zhejiang, China.

Abstract.

Objective: To address the challenges of abstract theoretical concepts and low practical application in medical statistics teaching, this study proposes an innovative teaching model integrating Doubao AI and R software, focusing on the F-distribution with numerator degrees of freedom (df_1) = 2 and denominator degrees of freedom (df_2) = 27.

Methods: A comparative teaching experiment was conducted among 52 medical students, divided into an experimental group ($n=26$) adopting the dual-software integrated model and a control group ($n=26$) using traditional teaching methods. The teaching process included AI-assisted theoretical interpretation, R-based data simulation, and case-driven practical application. Academic performance, task completion efficiency, and student satisfaction were evaluated. Task completion efficiency and student satisfaction were evaluated.

Results: The average time for the experimental group to complete the teaching process of F-test was 10 ± 2 minutes, shorter than the traditional instruction's 30 ± 5 minutes. The duration required for this teaching process is shorter than that of traditional instruction. 100% of students in the experimental group believed that the dual-software integration helped them understand the application of F-distribution ($df_1=2$, $df_2=27$) in clinical research.

Conclusion: The integration of Doubao AI and R software effectively bridges the gap between theory and practice in F-distribution teaching, improves students' statistical thinking and operational capabilities as well as learning efficiency and satisfaction, and provides a replicable solution for the digital reform of medical statistics courses.

Key words. Medical statistics teaching, Doubao AI, R software, dual-software integration, F-distribution, one-way ANOVA, case-based learning, digital teaching reform.

Introduction.

Medical statistics serves as the cornerstone of evidence-based medicine and clinical research [1], with the F-distribution being a core concept widely applied in analysis of variance (ANOVA) and variance homogeneity tests. However, traditional teaching of F-distribution often relies on theoretical lectures and manual calculations, leading to students' difficulties in understanding the logical relationship between degrees of freedom and distribution characteristics. Specifically, the F-distribution with $df_1=2$ and $df_2=27$, commonly used in three-group comparison studies, poses challenges for students in grasping its application scenarios and result interpretation.

The advancement of digital technology has driven the transformation of statistical teaching. R software [2], with its powerful data analysis and visualization capabilities, has been proven to enhance students' practical skills. Meanwhile, Doubao AI [3], as a high-performance large language model, excels

in natural language interaction and personalized guidance. Previous studies have shown that AI-assisted teaching tools can significantly improve student participation and knowledge mastery. This study innovatively integrates Doubao AI and R software to construct a "theoretical interpretation-simulation verification-case application" teaching framework, aiming to optimize the teaching effect of F-distribution ($df_1=2$, $df_2=27$) and promote the digital reform of medical statistics teaching.

Teaching Design and Implementation.

Teaching Objectives:

The teaching objectives are threefold: (1) Master the basic principles of F-distribution, especially the characteristics of the distribution with $df_1=2$ and $df_2=27$; (2) Proficiency in using R software for F-distribution probability calculation, critical value query, and visualization; (3) Ability to apply F-distribution to solve practical medical research problems such as three-group treatment effect comparison.

Software Integration Mechanism:

Doubao AI's Role: As an intelligent teaching assistant, Doubao AI undertakes three key tasks: 1) Plotting the theoretical probability density curve of F-distribution with $df_1=2$ and $df_2=27$ via built-in density function, instead of random value simulation; 2) Providing personalized guidance by answering students' real-time questions about R code writing and result interpretation; 3) Generating customized case datasets based on students' learning progress, such as clinical data of three groups of patients with different drug treatments.

R Software's Role: Responsible for practical operation implementation, including: 1) Simulating F-distribution curves with $df_1=2$ and $df_2=27$ using $df()$, $pf()$, and $qf()$ functions; 2) Conducting F-tests for variance homogeneity and ANOVA through built-in datasets; 3) Visualizing distribution characteristics and analysis results with `ggplot2` package.

Case-Based Teaching Process:

A real clinical research case was adopted: "In a Phase I clinical trial evaluating the tolerability and safety of a drug, 30 healthy volunteers who met the inclusion criteria were randomly divided into 3 groups of 10 each. Each group was injected with doses of 0.5U, 1U, and 2U, respectively. The 48-hour activated partial thromboplastin time (APTT, in seconds) was observed. The results are shown in Table 1. Question: Is there a difference in APTT among different dose groups?". The sample size was 30 (10 cases per group), with $df_1=k-1=2$ ($k=3$ groups) and $df_2=N-k=27$ ($N=30$ total samples), corresponding to the target F-distribution.

Step 1: AI-Assisted Theoretical Foundation.

Doubao AI explains the F-distribution definition: the ratio of two independent chi-square variables divided by their respective

degrees of freedom, with the formula $F = \frac{MS_B}{MS_W}$ (between-group mean square/within-group mean square).

Through interactive question and answer, Doubao AI clarifies why $df_1=2$ and $df_2=27$ in this case: " df_1 reflects the variation between the three drug groups, while df_2 represents the random error variation within each group after excluding group effects".

The AI generates a visual comparison chart of F-distributions with different degrees of freedom, highlighting that the F-distribution with $df_1=2$ and $df_2=27$ is moderately right-skewed, with a critical value of 3.35 at $\alpha=0.05$.

Step 2: R-Based Simulation and Calculation.

Students execute R code under Doubao AI's guidance:

Calculate critical value and probability:

```
# Calculate critical value and upper tail P-value
critical_value <- qf(p = 0.95, df1 = 2, df2 = 27) # Critical value
at  $\alpha=0.05$ : 3.35
p_value <- pf(q = 4.5, df1 = 2, df2 = 27, lower.tail = FALSE) #
Upper-tailed P-value when  $F=4.5$ 
```

Visualize distribution curve:

```
install.packages("ggplot2")
library(ggplot2)
x <- seq(0, 12, by = 0.01)
y <- df(x, df1 = 2, df2 = 27)
ggplot(data.frame(x = x, y = y), aes(x = x, y = y)) +
  geom_line(col = "steelblue", linewidth = 1) +
  geom_vline(xintercept = critical_value, color = "red",
    linetype = "dashed") +
  annotate("text", x = 3.8, y = 0.2, label = "Critical value: 3.35") +
  labs(title = "F-distribution (df1 = 2, df2 = 27)", x = "F-value",
    y = "Density")
```

After executing the above visualization code, Figure 1 will be generated. Doubao AI interprets the results in real time: "The red dashed line represents the critical value. When the calculated F-statistic exceeds 3.35, we reject the null hypothesis that the three drug effects are equal".

Step 3: Case Application and Result Interpretation.

```
# 1. Input the raw data
dose_0.5U <- c(36.8, 34.4, 34.3, 35.7, 33.2, 31.1, 34.3, 29.8,
  35.4, 31.2)
dose_1U <- c(40.0, 35.5, 36.7, 39.3, 40.1, 36.8, 33.4, 38.3,
  38.4, 39.8)
dose_2U <- c(32.9, 37.9, 30.5, 31.1, 34.7, 37.6, 40.2, 38.1,
  32.4, 35.6)
# 2. Reshape data into a data frame (long format for aov
function)
data <- data.frame(
  time = c(dose_0.5U, dose_1U, dose_2U),
  dose = factor(rep(c("0.5U", "1U", "2U"), each = 10)))
```

Conduct ANOVA using F-test:

```
# 1. Perform one-way analysis of variance (ANOVA)
aov_model <- aov(time ~ dose, data = data)
summary(aov_model)
# 4. (Optional) post-hoc test (Tukey's HSD) for pairwise
comparisons
TukeyHSD(aov_model)
```

When you run `summary(aov_model)`, you will get an ANOVA table consistent with the manual calculation in the problem (Figure 2).

The F-statistic is approximately 6.52, and the p-value is 0.0048 (less than 0.05).

We reject the null hypothesis (H_0), meaning there is a statistically significant difference in the mean APTT values among the three dose groups.

The TukeyHSD function will further show pairwise comparison results between the three groups to identify which specific groups differ.

Result interpretation with Doubao AI:

The AI assists students in analyzing: "Null Hypothesis (H_0): All three dose groups have the same mean partial thromboplastin time ($\mu_{0.5U} = \mu_{1U} = \mu_{2U}$).

Alternative Hypothesis (H_1): At least one group mean is different from the others.

Since $p=0.004888 < 0.05$, we reject the null hypothesis.

Final Interpretation: There is a statistically significant difference in the mean 48-hour partial thromboplastin time among the three different dose groups ($F(2,27) = 6.52$, $p=0.0049$). This indicates that the drug dose has a significant effect on the partial thromboplastin time.

If you want to identify which specific groups differ, you would perform a post-hoc test (e.g., Tukey's HSD) next.

Teaching Effect Evaluation.

Evaluation Indicators:

Satisfaction Survey: Five-point Likert scale questionnaire (1=strongly dissatisfied, 5=strongly satisfied) covering teaching method, software usability, and knowledge mastery. The control group adopted fully traditional offline teaching mode; teachers manually deduced F-distribution formulas and checked critical values via printed statistical tables. Students finished the identical three-group APTT ANOVA assignment entirely by hand calculation and paper table lookup, without any statistical software or AI assistance to ensure fair comparison with the experimental group.

Results.

Teaching Efficiency: The average time for the experimental group to complete the teaching process of F-test was 10 ± 2 minutes, shorter than the traditional instruction's 30 ± 5 minutes. The duration required for this teaching process is shorter than that of traditional instruction.

Satisfaction Survey: 100% of students in the experimental group believed that the dual-software integration helped them understand the application of F-distribution ($df_1=2$, $df_2=27$) in clinical research.

Discussion.

Advantages of Dual-Software Integration.

The integration of Doubao AI and R software addresses key pain points in F-distribution teaching:

Theoretical Simplification: Doubao AI's natural language interpretation and visual analogies make abstract concepts such as degrees of freedom more understandable, overcoming students' fear of mathematics.

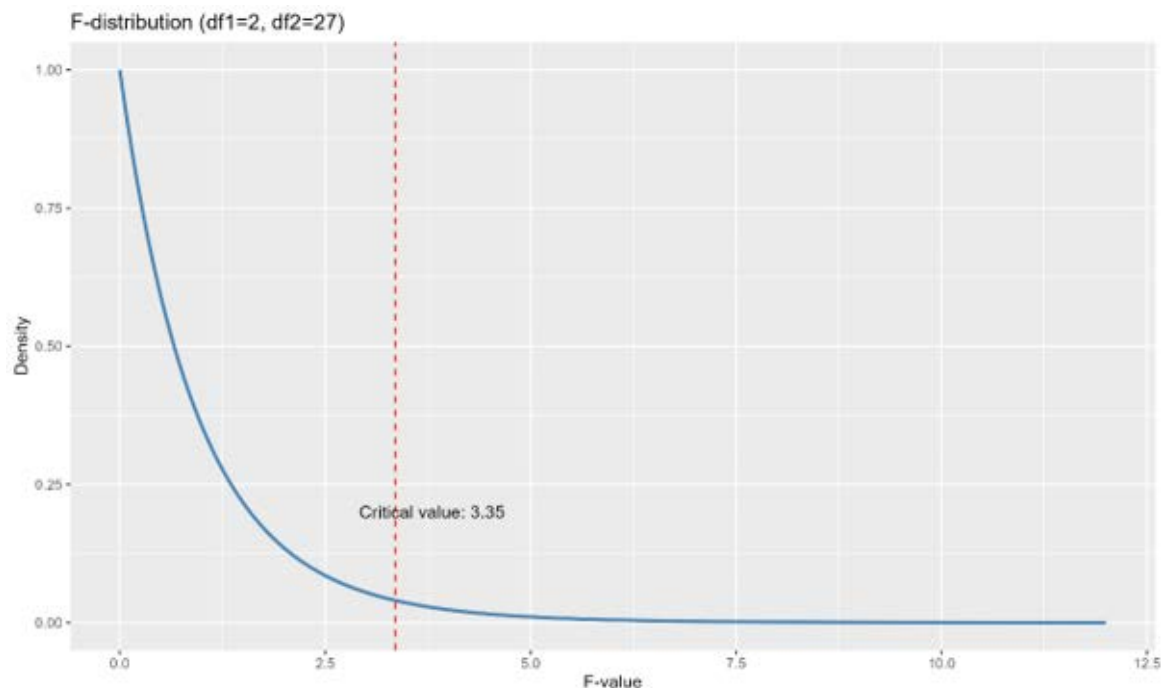


Figure 1. Density curve of the F-distribution with numerator degrees of freedom (df_1)=2 and denominator degrees of freedom (df_2) =27.

```
> summary(aov_model)
              Df Sum Sq Mean Sq F value    Pr(>F)
dose           2  91.22   45.61    6.524 0.00488 **
Residuals     27 188.76    6.99
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure 2. Summary(aov_model).

Table 1. 48-hour APTT of three different dose groups (Unit: s).

0.5U	1U	2U
36.8	40.0	32.9
34.4	35.5	37.9
34.3	36.7	30.5
35.7	39.3	31.1
33.2	40.1	34.7
31.1	36.8	37.6
34.3	33.4	40.2
29.8	38.3	38.1
35.4	38.4	32.4
31.2	39.8	35.6

Practical Enhancement: R software enables students to directly simulate distribution characteristics and conduct statistical tests, transforming passive learning into active operation.

Personalized Guidance: Doubao AI provides real-time answers to individual questions, solving the problem of insufficient teacher-student interaction in traditional classrooms.

Application Value of the Case Design.

The selected clinical pharmacology trial case focusing on different injection doses of the experimental drug has practical significance. It strictly corresponds to the F-distribution with

$df_1=2$ and $df_2=27$, helping students establish a direct connection between theoretical parameters and practical scenarios.

The case covers the entire process from data simulation to ANOVA, enabling students to master the complete application chain of F-distribution.

Limitations and Future Directions.

This study has two limitations: First, the sample size is relatively small, and multi-center experiments with more students are needed for verification; second, the teaching model focuses on F-distribution, and its applicability to other statistical methods require further exploration. Future work will:1)

Expand the application scope of dual-software integration to include t-distribution, chi-square distribution, etc.2) Optimize Doubao AI's teaching functions, such as adding automated error correction for R code.3) Establish a long-term evaluation mechanism to track students' application of statistical methods in subsequent clinical research.

Conclusion.

This study constructs an innovative teaching model for medical statistics by integrating Doubao AI and R software, with a focus on the F-distribution ($df_1=2$, $df_2=27$). The results show that this model significantly improves students' learning efficiency and learning satisfaction. It not only provides a new path for the digital reform of medical statistics courses but also offers a replicable example for the integration of AI and statistical software in higher medical education. The combination of intelligent theoretical guidance and practical operational tools is expected to become a mainstream trend in medical statistics teaching, helping to cultivate more competent medical research and clinical practice talents.

Conflict of Interest Statement.

The authors declare that this research was conducted in the absence of any business or financial relationships that could be construed as potential conflicts of interest.

Data Availability.

Data is provided within the manuscript.

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Consent for Publication.

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