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Anesthesia Residents Have Limited Knowledge of Biostatistics

ABSTRACT

We surveyed 27 anesthesiology residents to determine their basic understanding of biostatistics. We wanted to see how well they could interpret statistical presentation in biomedical literature and assess research outcomes. The questionnaire included three sections: demographics of the participants, their knowledge of statistics (21 questions) and their attitude and self reported confidence about biostatistics. Recognition of a meta-analysis was the highest scoring question (85% gave the correct answer), and recognition of a case-control study scored the lowest (22%). There was no effect of gender, the year of study, the number of years elapsed since graduation at the medical school, or country in which the participants had attended medical school (US or foreign schools). The only factor that increased the number of correct answers significantly was an additional course in biostatistics that two participants had attended after graduation. Sixty six percent indicated they did not understand all of the statistics they encountered in journal articles, but all of the participants felt it was important to be able to understand the literature. We conclude that most residents in this study lack the knowledge in biostatistics needed to interpret results in medical publications. Most participants in this survey expressed the desire to improve their knowledge on this subject, even though it would require taking special courses in basic epidemiology, and statistics for the non-statistician during their residency training.

KEY WORDS
Anesthesiology residents, knowledge biostatistics, survey, medical publications.

Most biomedical and clinical studies involve the selection of a small sample from a larger population (humans, animals, microorganisms, etc), from which the findings can be then extrapolated to the larger population with varying degrees of confidence. Thus, it is important to understand what each of the statistical tools can do and how to use them properly. A basic understanding of statistics and epidemiological principles related to experimental design, methodology, data analysis, and interpretation of findings is also necessary to understand publications of evidence-based medicine and the majority of clinical studies.[1] Because physicians depend on published literature to keep current with medical information, they need to understand statistical methods in order to interpret published research outcomes appropriately.

Medical researchers in academic medicine need advanced knowledge of these skills to plan and successfully conduct a study and to analyze data acquired from clinical investigations. Thanks to Ronald Fisher (1890-1962), powerful statistical methods have made a great impact on studies related to health, and these methods continued to improve. Today we can prepare a good study design, estimate adequate sample size, and provide reliable analysis of the results.[2] Medical researchers often seek help from a professional statistician to solve complex statistical demands. However, simple experimental design and estimate of the essential sample size is usually straightforward. Even when a statistician is readily available, the investigator needs a basic knowledge of study design, factors affecting sample size, and the appropriate statistical test in order to obtain the best results. A well-informed investigator will prepare a better research design and make the proper statistical evaluation of the data collected.

One obstacle common to novice researchers is how to report the data for publication in a journal. To help them de-

termine how to present their data, there are available several useful papers on how to use standard deviation (SD) or standard error of the mean (SEM, or SE), confidence intervals (CI) and other details, such as when to use particular statistical tool.[3,4]

A recent study[5] found that most residents in internal medicine lack the knowledge of biostatistics needed to interpret many of the results in published clinical research. We questioned anesthesiology residents on their basic understanding of biostatistics in order to identify specific areas that should be included in the residency program to prepare residents for this important lifelong learning skill.

Methods
Twenty-seven residents in the department of Anesthesiology and Pain Management of the Stroger Hospital of Cook County agreed to participate in this study. They answered a questionnaire that included three sections: the demographics of participants, their basic knowledge of statistics (21 questions) and their attitude and self reported confidence about biostatistics. The participants in this descriptive study had to complete the document individually under the conditions of a formal examination. Knowledge scores were expressed as the percentage of correct answers. Missing answers were counted as incorrect answers. All analyses of the data obtained were performed with InStat software.

Results
All 27 participants (12 females and 15 males; 6 US and 21 foreign graduates) in our department completed their questionnaires. The table shows the percentage score for the twelve selected questions answered correctly. Recognition of a meta-analysis was the highest scoring question (85%), and the lowest score was in recognizing case-control study (22%). There was no effect of gender, the year of study, the number of years elapsed since graduation at the medical school, or country in which the participants had attended medical school (US or foreign schools). The only factor that increased the number of correct answers significantly was an additional course in biostatistics that was attended two participants after graduation. Sixty-six percent indicated they did not understand all of the statistics they encountered in journal articles, but all of them felt it was important to understand the literature. Twenty of the participants stated that they would like to devote time to additional study of statistics, especially to understand the principles of probability and research design.

Table: Correct answers for selected questions

Subject to identify, recognize or interpret	Per cent of correct answers
Continuous variable	48
Case-control study	22
Cohort study	63
Meta-analysis	85
P value	52
Purpose of double blinding	78
Purpose of randomization	56
Null hypothesis	59
t-test	37
Chi-square	48
Analysis of variance (ANOVA)	74
95% Confidence interval	48

Discussion
The results of this survey show that anesthesia residents need further education on the application and interpretation of basic epidemiological principles and biostatistics. Similar findings were obtained when we tested the residents of various other clinical disciplines (55 participants) in Banja Luka with the same questionnaire translated in Serbian (unpublished observation). The majority of the residents in Banja Luka declared their interest in additional study of statistics, especially in how to design a study and how to estimate the number of patients to include. A nice short paper on the latter topic was published recently in the journal *Radiology*.[6]

Lack of understanding of statistics can lead to erroneous interpretations of research findings as well as the inability to critically assess published evidence. For those residents who wish to participate in clinical research, knowledge of statistics is essential. Not a single participant in our survey knew that statistical variability of the data (mean +/- SD for n observations, for example: 48 +/- 8, n= 42) could be presented as: 48, SD = 8, n = 42. This indicates that the textbooks of statistics they have been using probably do not include this recent change in statistical presentation.[3]

We conclude that most residents in our study lack the knowledge in biostatistics needed to interpret many results in medical publications. Most of the participants expressed their desire to improve their knowledge through courses in basic epidemiology and statistics for the non-statistician during residency training. Although there are many excellent books in statistics,[7,8] we presented short statistical

courses for the residents and the novice authors in our hospitals, both in Chicago and Banja Luka. We also included a chapter on basic statistics in our textbook on biomedical writing and publishing.[9] In addition, universities, large hospitals, and even medical journal editors could regularly organize courses designed to provide training in planning scientific research and statistics.

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Specijalizanti iz anesteziologije nedovoljno poznaju statisktiku

APSTRAKT

Anketirali smo 27 specijalizanata iz anesteziologije da ustanovimo osnovno razumevanje biostatistike. Želeli smo da ustanovimo kako oni interpretiraju statističke podatke u biomedicinskoj literaturi da bi procenili rezultate istraživanja. Upitnik je uključio tri segmenta: demografske podatke o anketiranim, njihovo poznavanje statistike, (21 pitanje) i njihov interes za biostatistiku. Najviše tačnih odgovora je dato na prepoznavanje meta-analize (85%), a najmanje na case–control studije (22%). Na broj tačnih odgovora nije uticao pol ispitanika, broj godina nakon završetka studija ili zemlju u kojoj su ispitanici završili medicinski fakultet. Jedini faktor koji je povećao broj tačnih odgovora bio je dodatni kurs biostatistike kod dva učesnika koji su ga pohađali nakon diplomiranja. Šezdeset šest procenata učesnika navelo je da bi voleli da boljim poznavanjem mogu svatiti članke iz literature. Zaključili smo da većina specijalizanata koje smo anketirali slabije poznaju biostatistiku neophodnu za interpretaciju medicinskih publikacija. Većina učesnika je izrazila želju da unapredi svoje znanje iz te oblasti, čak ako to zahteva dodatni kurs iz osnova epidemiologije i statistike potrebne ne/statističaru za vreme specijalizacije.

KLJUČNE REČI

Specijalizanti anesteziologije, poznavanja biostatistike, anketa, medicinske publikacije.