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The Big Data Awareness of Turkish Neurosurgeons: A National Survey

Türk Beyin Cerrahlarının Büyük Veri Farkındalığı: Ulusal Bir Araştırma

Fatih Yakar[1], Emrah Egemen[1], Emrah Çeltikçi[2], Şahin Hanalioğlu[3], Batuhan Bakirarar[4], Ümit Akın Dere[1], Serkan Civlan[1], Yücel Doğruel[5], Abuzer Güngör[6,7]

[1]Pamukkale University School of Medicine, Department of Neurosurgery, Denizli, Turkey.
[2]Gazi University, School of Medicine, Department of Neurosurgery, Ankara, Turkey.
[3]Hacettepe University, School of Medicine, Department of Neurosurgery, Ankara, Turkey.
[4]Ankara University, School of Medicine, Department of Biostatistics, Ankara, Turkey.
[5]Igdir State Hospital, Department of Neurosurgery, Igdir, Turkey.
[6]Bakirköy Research and Training Hospital for Psychiatry, Neurology and Neurosurgery, Department of Neurosurgery, Istanbul, Turkey.
[7]Yeditepe University School of Medicine, Department of Neurosurgery, Istanbul, Turkey.

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ABSTRACT

Objective: The term big data refers to high volumes of data that are difficult to store, process, and analyze through traditional database technologies. This paper aims to discover the big data knowledge and awareness of Turkish neurosurgeons.

Methods: An online survey link was sent to all members of the Turkish Neurosurgical Society (n=1707 neurosurgeons) by e-mail. The survey, which was available during September and October 2021, was filled by 211 specialists (12.4%) neurosurgeons. Participants were scored based on the questions asked in "Big Data" and the scores were compared with baseline characteristics.There was no statistically significant correlation between baseline characteristics (age, gender, the residency/current institution, academic title, the presence of a Ph.D. degree, and professional specialist period) and survey score. The survey scores of the participants who used a big data platform, wrote code, thought that the use of big data was beneficial, and wanted to learn more about this subject were statistically significantly higher.

Conclusions: Obtaining information about big data seems to be related only to personal interests. Necessary arrangements should be made in the training programs of neurosurgeons on this topic, which is gaining in popularity and provides useful information for daily clinical practice.

Keywords: Big data, neurosurgeon, national survey

Sorumlu yazar/Corresponding author: Fatih Yakar, Pamukkale University School of Medicine, Department of Neurosurgery, Denizli, Turkey. yakarneurosurgery@gmail.com / 0000-0001-7414-3766

ORCID:
E. Egemen 0000-0003-4930-4577, **E. Çeltikçi** 0000-0001-5733-7542, **Ş. Hanalioğlu** 0000-0003-4988-4938,
B. Bakirarar 0000-0002-5662-8193, **Ü. A. Dere** 0000-0002-6678-6224, **S. Civlan** 0000-0000-0000-0000,
Y. Doğruel 0000-0003-4314-5579, **A. Güngör** 0000-0002-2792-7610

ÖZ

Amaç: Büyük veri terimi, geleneksel veri tabanı teknolojileri aracılığıyla depolanması, işlenmesi ve analiz edilmesi zor olan yüksek hacimli verileri ifade eder. Bu makale, Türk beyin cerrahlarının büyük veri bilgisini ve farkındalığını keşfetmeyi amaçlamaktadır.
Yöntem: Türk Nöroşirurji Derneği'nin tüm üyelerine (n=1707 beyin cerrahı) e-posta ile online anket linki gönderildi. Eylül ve Ekim 2021'de online olarak erişilebilir olan anket 211 (%12,4) beyin cerrahisi uzmanı tarafından doldurduldu. Katılımcılar, "Büyük Veri" hakkında sorulan sorulara göre puanlandı ve puanlar temel özelliklerle karşılaştırıldı. Temel özellikler (yaş, cinsiyet, asistanlık yapılan/mevcut kurum, akademik unvan, doktora derecesinin varlığı ve uzmanlık süresi) ile anket puanı arasında istatistiksel olarak anlamlı bir ilişki yoktu. Büyük veri platformunu kullanan, kod yazan, büyük veri kullanımının faydalı olduğunu düşünen ve bu konuda daha fazla bilgi edinmek isteyen katılımcıların anket puanları istatistiksel olarak anlamlı derecede yüksekti.
Sonuç: Büyük veri hakkında bilgi edinmenin sadece kişisel merakla ilgili olduğu görülmektedir. Giderek artan ve günlük klinik pratiğe faydalı bilgiler sağlayan bu konuda beyin cerrahlarının eğitim programlarında gerekli düzenlemeler yapılmalıdır.

Anahtar Kelimeler: Büyük veri, beyin cerrahı, ulusal anket

INTRODUCTION

The concept of "Big Data", which emerged as the scale of data collection increased, became interpretable with the combination of statistics and computer science. The evolution of statistical modeling into machine learning led to artificial intelligence [1]. Event predictions, pattern recognition, and detailed image analysis are made possible by the existence of big data sets [2]. These stunning development paved the way for benefiting from large data sets in clinical practice. Machine learning is a constantly evolving and promising topic for decision-making in the treatment of different disease groups [3].

Big data is compared to traditional data; it is high volume, data generation speed is faster, can be structured/unstructured/semi-structured, the data source is fully distributed, data integration is difficult, and access is batch or real-time [4]. The backbone of big data consists of volume, velocity, variety, value, and veracity [5]. Big data analytics is used to detect hidden patterns and values that give an accurate expression of data [4,6,7].

In the last decade, the processing power and amount of research in big data analysis have been increasing [2]. In the current neurosurgical literature, big data analyzes are used in cranial [8-11], spinal [12-17], and peripheral nerve surgery [18]. The big data, which is stated to shape clinical practice [19] and improve the quality of patient care [2], needs to be noticed and benefited by today's neurosurgeons. This study aims to measure the knowledge and awareness level of Turkish specialist neurosurgeons about "Big Data".

MATERIAL AND METHODS

Online Survey

The online survey (Table 1) consisting of 21 questions was sent to all members of the Turkish Neurosurgical Society (n=1707 neurosurgeons) by e-mail. The answers of the participants who filled in all the questions in the survey were evaluated. Recurrent participation was not possible due to IP address tracking.

Two hundred and eleven specialists (12.4%) participated in the survey during September and October 2021. The participants were informed about the confidentiality of their data. All data were collected in an online database and then imported into Microsoft Excel. The questions in the survey were Turkish, the native language of the participants, and no residents participated in the survey. Ten questions specific to big data were evaluated out of a hundred points and the scores of the participants were compared with their baseline characteristics. The aforementioned ten questions were given scattered throughout the survey in order not to create the feeling of taking the exam in the participants.

Table 1. All questions from "The Big Data Awareness of Turkish Neurosurgeons: A National Survey" (* The Questions prepared to calculate the survey score)

Question	Possible responses
How old are you?	24–29, 30–34, 35–39, 40–44, ≥45
What is your gender?	Female, male
What is the nature of your residency institution?	Training and research/city hospital, state university, private university, foreign country
What is your academic title?	Specialist, assistant professor, associate professor, professor
Do you have a PhD degree?	Yes, no
How many years have you been a specialist neurosurgeon?	1–4, 5–8, 9–12, 13–16, ≥17
What is the nature of the institution you are currently working with?	State hospital, private hospital, state university, private university, training and research or city hospital/city hospital, foreign country
Big data can be defined as a collection of complex, unstructured, or semi-structured datasets*	Yes, no, I have no idea
The 5V concept of big data consists of volume, velocity, variety, value, and veracity*	Yes, no, I have no idea
No matter how big the size of big data increases, statistical significance does not change*	Yes, no, I have no idea
One of the biggest challenges of using big data is the shortage of storage space*	Yes, no, I have no idea
Data generation, data collection, data storage, data processing are the steps of big data*	Yes, no, I have no idea
Do you use any "big data" platform in your daily practice?	Yes, no
Hadoop, Cloudera, SPSS, and SAS are big data platforms*	Yes, no, I have no idea
Have you written code on any platform?	No, yes (one time), yes (two times), yes (three times), yes (more than three times)
I think big data platforms are useful in neurosurgery practice	Yes, no, I have no idea
Servers with very good features are required for the analysis of big data*	Yes, no, I have no idea
For a data to be called big data, it only needs to have a very large number of patients*	Yes, no, I have no idea
The reason why Hadoop is often used for big data analytics is that it is open source and low cost*	Yes, no, I have no idea
Big data platforms (applications) also allow the processing of media files*	Yes, no, I have no idea
I would like to know more about big data	Yes, no

Subgrouping of Questions and Participants

Questions were categorized into three groups: 1) base-line characteristics (including personal and institutional details), 2) questions measuring the level of big data knowledge (each question was evaluated as 10 points and the maximum total score that could be achieved was 100), and 3) interest and skills in big data. The survey score of participants were compared with questions categories 1 and 3.

Statistical Analysis

SPSS 11.5 program was used in the analysis of the data. Mean±standard deviation and median (minimum-maximum) were used as descriptors for quantitative variables, and the number of patients (percentage) for qualitative variables. The Mann-Whitney U test was used to determine whether there was a difference between the categories of the qualitative variable with two categories in terms of quantitative variables since the assumptions of normal distribution were not met. The Kruskal Wallis H test was used to determine whether there was a difference between the categories of the qualitative variable with more than two categories in terms of the quantitative variable since the assumptions of normal distribution were not met. The statistical significance level was taken as 0.05.

RESULTS

The baseline characteristics of participants are summarized in Table 2.

No statistically significant correlation was found between age, gender, the residency institution, academic title, the presence of a Ph.D. degree, professional specialist period, current institution, and survey score. (P=0.585, P= 0.986, P=0.544, P=0.065, P=0.781, P=0.276 and P= 0.113, retrospectively) (Table 3)

The survey scores of the participants who use any big data platform in their daily practice, who think that big data platforms are useful in neurosurgery practice, and who want to learn more about big data, are statistically significantly higher. (P=<0.001, P=<0.001 and P=0.048 retrospectively) In addition, the survey scores of the participants who wrote code twice on any platform were statistically significantly higher than the others. (P=0.008) (Table 4)

DISCUSSION

Although academic performance surveys have been conducted on similar populations [20] before, this study on big data awareness is a first in this regard. In our study, the fact that the survey scores could not be associated with baseline characteristics shows that Turkish health institutions do not have sufficient training programs on this subject and the awareness of big data is limited only to personal interest. In our previous study [20], although we determined that university hospitals in Turkey were superior in scientific activities, in this study, no superiority of these institutions could be determined about big data.

The adequacy of traditional clinical research methods, which cannot handle the volume, variability, speed, and accuracy of data, is questioned by data science. Although the basic principles of epidemiology, study design, and biostatistics remain important, they should be supported by machine learning and database management. Soon, programming skills will be one of the core competencies of the neurosurgeon. Educators should ensure that future neurosurgeons receive training on this subject [21].

A recent national survey study was conducted to question the effects of the COVID 19 pandemic on education for neurosurgery residents (participation rate was 54%) across Turkey. 59.6% of the participants in the study stated that they did not participate in any research during this period, 34.2% stated that research productivity decreased and 42% stated that they were concerned about residency training and future career [22]. The study [22] which shows that fundamental neurosurgery education was disrupted during the pandemic period, makes us think that future specialists will possibly not be interested in big data.

Currently, residency training in the Republic of Turkey is carried out in tertiary health institutions (State/Private university hospitals, training and research/city hospitals). Post-residency physicians may work in private hospitals, state hospitals, or tertiary healthcare institutions [20]. The reason why we draw special attention to residency and current institutes while measuring the level of knowledge and awareness about a current issue such as big data is the polycentricity and lack of standardization in neurosurgery training. While the residency institutes of the participants are mostly from state universities (56.9%), the current institute is the most common

Table 2. The descriptive data about survey participants

Variables		
Age (years), n (%)	24-29	4 (1.9)
	30-34	44 (20.9)
	35-39	56 (26.5)
	40-44	56 (26.5)
	≥45	51 (24.2)
Gender, n (%)	Male	191 (90.5)
	Female	20 (9.5)
The nature of residency institution, n (%)	State university	120 (56.9)
	Training and research/city hospital	83 (39.3)
	Private university	5 (2.4)
	Foreign country	3 (1.4)
Academic title, n (%)	Specialist	130 (61.6)
	Assistant professor	31 (14.7)
	Associate professor	37 (17.5)
	Professor	13 (6.2)
The presence of PhD degree, n (%)	No	193 (91.5)
	Yes	18 (8.5)
Professional specialist period (years), n (%)	1-4	67 (31.8)
	5-8	53 (25.1)
	9-12	50 (23.7)
	13-16	14 (6.6)
	>16	27 (12.8)
The nature of current institution, n (%)	State hospital	48 (22.7)
	State university	47 (22.3)
	Training and research/city hospital	70 (33.2)
	Private hospital	33 (15.6)
	Private university	9 (4.3)
	Foreign country	4 (1.9)
The use of big data platform in daily practice, n (%)	No	188 (89.1)
	Yes	23 (10.9)
The code writing, n (%)	No	185 (87.7)
	Yes (one time)	17 (8.1)
	Yes (two times)	2 (0.9)
	Yes (more than three times)	7 (3.3)
I think big data platforms are useful in neurosurgery practice, n (%)	No	6 (2.8)
	Yes	86 (40.8)
	I have no idea	119 (56.4)
The desire to learn more about big data, n (%)	No	35 (16.6)
	Yes	176 (83.4)
Survey score	Mean±SD	27.91±23.99
	Median (Min.-Max.)	20.00 (0.00-80.00)

training and research/city hospital (33.2 %). These rates support the conclusion that these institutions, which we stated in our previous study [20], are more scientifically active. In the question about whether the code was written on the big data platform, the survey score of the people who wrote the most code was expected to be the highest, while the code score was determined to be the highest two times. This is possible because coding is a team effort and not everyone on the team can be at the same level of knowledge.

Table 3. The comparison of survey score with categories of demographic variables

Variables		Survey score		P value
		Mean±SD Median	Mean±SD Median	
Age (years), n(%)	24-29	45.00±10.00	50.00 (30.00-50.00)	0.585[b]
	30-34	26.14±22.12	20.00 (0.00-70.00)	
	35-39	26.61±26.03	10.00 (0.00-80.00)	
	40-44	29.46±24.45	20.00 (0.00-80.00)	
	≥45	27.84±23.61	30.00 (0.00-70.00)	
Gender, n (%)	Male	28.06±24.19	20.00 (0.00-80.00)	0.986[a]
	Female	26.50±22.54	20.00 (0.00-70.00)	
The nature of residency institution, n (%)	State university	26.92±23.86	20.00 (0.00-80.00)	0.544[b]
	Training and research/city hospital	28.31±23.88	30.00 (0.00-70.00)	
	Private university	42.00±21.68	50.00 (10.00-60.00)	
	Foreign country	33.33±40.41	10.00 (10.00-80.00)	
Academic title, n (%)	Specialist	24.85±23.10	15.00 (0.00-80.00)	0.065[b]
	Assistant professor	34.52±23.78	40.00 (0.00-80.00)	
	Associate professor	32.70±25.46	20.00 (0.00-70.00)	
	Professor	29.23±26.29	30.00 (0.00-70.00)	
The presence of PhD degree, n (%)	No	27.77±24.17	20.00 (0.00-80.00)	0.781[a]
	Yes	29.44±22.61	35.00 (0.00-60.00)	
Professional specialist period (years), n (%)	1-4	26.42±22.74	20.00 (0.00-80.00)	0.276[b]
	5-8	23.02±23.00	10.00 (0.00-70.00)	
	9-12	32.80±25.80	30.00 (0.00-80.00)	
	13-16	33.57±26.49	50.00 (0.00-70.00)	
	>16	29.26±23.52	30.00 (0.00-70.00)	
The nature of current institution, n (%)	State hospital	21.25±21.10	15.00 (0.00-70.00)	0.113[b]
	State university	32.55±23.73	40.00 (0.00-80.00)	
	Training and research/city hospital	26.00±24.10	15.00 (0.00-70.00)	
	Private hospital	32.12±24.84	40.00 (0.00-70.00)	
	Private university	33.33±26.46	20.00 (0.00-70.00)	
	Foreign country	40.00±35.59	35.00 (10.00-80.00)	

Mean:Mean, SD:Standard Deviation, Min:Minimum, Max:Maximum, a:Mann-Whitney U test, b:Kruskal Wallis H test

Table 4. The comparison of survey score with interest and skills in big data

Variables		Survey score		P value
		Mean±SD	Median (Min.-Max.)	
The use of big data platform in daily practice, n (%)	No	25.53±23.41	20.00 (0.00-80.00)	<0.001[a]
	Yes	47.39±19.82	50.00 (0.00-70.00)	
The code writing, n (%)	No	26.00±23.60	20.00 (0.00-80.00)	0.008[b]
	Yes (one time)	45.88±22.65	50.00 (0.00-80.00)	
	Yes (two times)	50.00±0.00	50.00 (50.00-50.00)	
	Yes (more than three times)	28.57±22.68	30.00 (0.00-60.00)	
I think big data platforms are useful in neurosurgery practice, n (%)	No	46.67±25.03	55.00 (0.00-70.00)	<0.001[b]
	Yes	47.09±17.48	50.00 (0.00-80.00)	
	I have no idea	13.11±16.45	10.00 (0.00-80.00)	
The desire to learn more about big data, n (%)	No	20.29±21.76	10.00 (0.00-70.00)	0.048[a]
	Yes	29.43±24.18	30.00 (0.00-80.00)	

Mean:Mean, SD:Standard Deviation, Min:Minimum, Max:Maximum, a:Mann-Whitney U test, b:Kruskal Wallis H test

While evaluating frequently performed surgeries worldwide, single-center studies do not provide sufficient statistical power to make a general judgment [18]. In addition, due to the nature of single-center studies, these studies reflect the experiences of a small number of surgeons [12]. Samaga et al. [23] suggested the use of multi-center datasets instead of single-center since the most important priority when making therapeutic decisions would be to minimize the prediction error. Thus, consensus can be reached with the big data provided by the data sets [18]. Big data analyses published in all areas of neurosurgery [2,8,9,10-18] provide useful advice to clinicians by examining large specific patient groups. There are also publications [24] that the big data model does not provide answers to questions about complex neurosurgical procedures. The concern of these authors is that manipulation of databases is highly possible [24]. Although not accurate for a single patient, they can provide a zoom-out and abstract perspective that cannot be detected without evaluating a large patient group. However, they do not have zoom-in capabilities on a particular observation or question that emerges from an analysis.

Globally, many patients in low- and middle-income countries do not have access to life-saving neurosurgical procedures. Assessing the overall burden of neurosurgery disease, planning cost-effective improvements in access to neurosurgical care, and collecting information on conditions that are rare in developed countries are potential applications of big data in neurosurgery [25].

As neurosurgeons who have always pioneered innovation in the medical community, we are experiencing an analytical revolution that threatens to be caught unprepared to examine and evaluate the patient data we collect. It is our responsibility to use new techniques of modern data science to improve our practices and the quality of life of our patients [21].

CONCLUSION

The knowledge level and awareness of big data are not related to any baseline characteristics for Turkish neurosurgeons. Obtaining information about big data is only associated with personal interests. In today's world, where traditional data has evolved into big data and given direction to clinical approaches, the training of neurosurgeons should be given importance in this regard.

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