

Evaluation of the Effects of the Education on Deep Vein Thrombosis in the Virtual Classroom on the Knowledge, Attitude and Practices of the Students in the Field of Health: Semi-Experimental Design

Sanal Sınıfta Derin Ven Trombozuna Yönelik Verilen Eğitimin Öğrencilerin Sağlık Alanındaki Bilgi, Tutum ve Uygulamalarına Etkisinin Değerlendirilmesi: Yarı-Deneysel Araştırma

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ABSTRACT Objective: The impact of the coronavirus pandemic on various sectors was widespread, with a notable influence on the education system. This study was designed to assess the impact of deep vein thrombosis (DVT) education in a virtual classroom setting on the knowledge, attitude, and practices of students enrolled in the vocational school of health services amid the coronavirus pandemic. **Material and Methods:** Conducted as a semi-experimental design with a single-group pre-test-post-test structure, the study involved students from a state university's vocational school of health services (n=90). Participants underwent DVT training, and their knowledge, attitude, and practices were measured before and after the training. Data collection took place from April 20 to June 20, 2022, utilizing a DVT knowledge, attitudes, and practices information form developed by the researchers. Descriptive data were assessed using numbers, percentages, mean, and standard deviation, while the McNemar chi-square test and student t-test were employed for variable comparisons. **Results:** Of the participants, 74.4% were female, with a mean age of 20.32±2.8 years, and 64.5% were enrolled in the first aid and emergency aid program. 87.9% found the online training to be sufficient. Statistically significant differences were observed between pre-test and post-test scores (p<0.05). **Conclusion:** The virtual classroom education on DVT was found satisfactory by the majority of students, resulting in an evident improvement in their knowledge, attitude, and practices.

Keywords: COVID-19; knowledge; online education; student; venous thrombosis

ÖZET Amaç: Tüm sektörleri etkisi altına alan koronavirüs pandemisinin büyük yansması içinde eğitim sistemi de yer almaktadır. Bu çalışma, koronavirüs pandemisi döneminde sanal sınıf ortamında verilen derin ven trombozu (DVT) eğitiminin sağlık hizmetleri meslek yüksekokulu öğrencilerinin bilgi, tutum ve uygulama düzeylerine etkisini belirlemek amacıyla planlanmıştır. **Gereç ve Yöntemler:** Tek grup ön-test ve son test desenine sahip bu yarı deneysel çalışmanın evrenini bir devlet üniversitesinin sağlık hizmetleri meslek yüksekokuluna devam eden öğrenciler (n=90) oluşturmuştur. Katılımcılara DVT konusunda eğitim verilmiş, eğitim öncesi ve sonrası bilgi, tutum ve uygulama düzeyleri değerlendirilmiştir. Veriler, araştırmacılar tarafından oluşturulan DVT bilgi, tutum, uygulama bilgi formu kullanılarak 20 Nisan-20 Haziran 2022 tarihleri arasında toplanmıştır. Tanımlayıcı verilerin değerlendirilmesinde sayı, yüzde, ortalama ve standart sapma, değişkenlerin karşılaştırılmasında McNemar ki-kare testi ve Student t-testi kullanılmıştır. **Bulgular:** Katılımcıların %74,4'ü kadın, yaş ortalaması 20,32±2,8 ve %64,5'i ilk ve acil yardım programı öğrencisidir. Yüzde 87,9'u çevrim içi eğitimi yeterli bulmuştur. Ön-test ve son-test puanları arasında istatistiksel olarak anlamlı bir fark bulunmuştur (p<0,05). **Sonuç:** Öğrenciler çoğunlukla sanal sınıf ortamında verilen DVT eğitimini yeterli bulmuş, bilgi, tutum ve uygulama düzeylerinde artış saptanmıştır.

Anahtar Kelimeler: COVID-19; bilgi; çevrim içi eğitim; öğrenci; venöz tromboz

Deep vein thrombosis (DVT) emerges as a preventable health concern attributed to alterations in blood flow within any segment of the venous system,

predominantly affecting the lower extremities (90%).^{1,2} Recognized as a potentially life-threatening condition, DVT carries a significant burden of mor-

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tality and morbidity, with reported incidences ranging from 48 to 160 cases per 100,000 individuals.²⁻⁵ The development of DVT is influenced by a combination of hereditary and environmental risk factors, with the concurrent presence of both factors amplifying the incidence.⁶ Identified risk factors encompass immobility (especially for durations exceeding 72 hours), a history of venous thromboembolism, advanced age, obesity, pregnancy, oral contraceptive use (particularly those containing estrogen), acute infections, cerebrovascular accidents, and chronic lung disease. Surgical patients face additional risk factors, including the duration of the operation, anesthesia method, and postoperative immobility period.^{3,7-9}

Initial symptoms observed in patients following DVT onset include pitting edema, ankle fullness, redness, skin discoloration, and tachycardia.^{10,11} The most perilous complication stemming from DVT is pulmonary embolism.¹ Healthcare professionals play a crucial role in assessing DVT development in patients. Consequently, students pursuing studies in health-related disciplines should acquire adequate knowledge and skills pertaining to DVT risk factors, symptoms, and indicators.

The educational process serves as a pivotal period during which students can gain accurate insights into this subject. However, the coronavirus disease-2019 (COVID-19) pandemic has instigated transformative changes in education, mirroring the broader shifts in various facets of life.^{12,13} Notably, traditional educational models have been replaced by online education, characterized as an instructional endeavor aimed at enhancing interaction among students, instructors, and learning resources.^{12,14} Online education presents numerous advantages, such as being student-centered, devoid of time and place restrictions, and incurring lower educational expenses.¹⁵ However, relevant studies highlight the potential drawbacks of online education, particularly in disciplines that demand hands-on practical skills in the realm of health.¹²

Numerous students completed their studies in the field without the customary hands-on experiences in clinical settings due to virtual classrooms during the pandemic. While students pursuing associate degree education in the health field typically undergo manda-

tory clinical skills training, the pandemic compelled them to graduate without direct patient interactions. Consequently, this research aims to assess the impact of DVT education, a crucial subject, on students' levels of knowledge, attitudes, and practices during the COVID-19 pandemic in the virtual classroom.

RESEARCH QUESTIONS

What is the influence of DVT training in a virtual classroom setting on students' knowledge, attitudes, and practices?

How do sociodemographic factors affect students' access to education in the virtual classroom?

What is the satisfaction level of students regarding the education they receive in the virtual classroom environment?

MATERIAL AND METHODS

TYPE OF STUDY

The research was conducted in a single-group pretest-posttest design.

STUDY POPULATION

The population consisted of first-year students studying in the dialysis and first and emergency aid program of a vocational school of health services in the spring semester of the 2021-2022 academic year (n=100). Without sampling, 90 students (90%) who agreed to participate in the study were recruited for the study.

DATA COLLECTION

Upon obtaining written permission, the researchers developed the study's data collection form by reviewing relevant literature. Data were collected using Google Forms (Google Company, Alphabet Inc., USA) and distributed to the entire class (n=100). However, only data from volunteer students who agreed to participate (n=90) were considered. The collection period spanned from April 20 to June 20, 2022.

PARTICIPANT INFORMATION FORM AND DATA COLLECTION TOOLS

The form comprises two parts. The first part involves six questions about participants' descriptive characteristics. The second part includes 18 questions ex-

ploring participants' knowledge, attitude, and practices regarding DVT, along with a satisfaction questionnaire. Responses are categorized as "yes", "partially", and "no", with corresponding scores of 2, 1, and 0. The total scores range from 0 to 36, with a high Cronbach alpha reliability coefficient of 0.89.

An informed consent form is present in the first part of the form. The form served as a pre-test for online education. Following a one-week interval, students received online education on DVT for 3 hours per week over 2 weeks. The online materials were research-oriented, incorporating visual content like photographs and videos. The same data collection tool was employed as a post-test 4 weeks after the education, based on literature findings.^{2,4,8}

ETHICAL CONSIDERATIONS

The study protocol was approved by the Ethics Committee at Giresun University (date: March 18, 2021; no. E-90139838-000-1089). Informed written consent was obtained from the students before the study, and participation in the study was voluntary and based on willingness. Ethical standards outlined in the Declaration of Helsinki were strictly adhered to.

STATISTICAL ANALYSIS

The data were analyzed using the IBM SPSS 25 (IBM Corp., Armonk, NY, USA) package program. The conformity of the data to the normal distribution was done with the Kolmogorov-Smirnov test. Descriptive statistics (numbers, percentages, mean, and standard deviation) were employed. McNemar, chi-square, and t-tests were applied, with a significance level set at $p < 0.05$.

RESULTS

Table 1 presents the sociodemographic profile of the participating students. The average age of the students in the study was 20.32 ± 2.8 years, with a predominant representation of females at 74.4%. A significant portion, 64.5%, were enrolled in the first and emergency program. Regarding technology access, 42.2% of students did not have personal or public computers, while 83.3% did not encounter issues purchasing an internet quota. However, 62.2% faced difficulties in accessing online education, as indicated in **Table 1**.

TABLE 1: Sociodemographic characteristics of students.

Sociodemographic Characteristics	n	%
Age	20.32±2.8	
Gender		
Female	67	74.4
Male	23	25.6
Department		
Dialysis department	32	35.5
First and emergency department	58	64.5
Having a personal or public computer in the distance education process		
Yes	52	57.8
No	38	42.2
Experiencing difficulties in accessing distance education		
Yes	34	37.8
No	56	62.2
Possibility of purchasing and using the Internet		
Yes	75	83.3
No	15	16.7

Table 2 presents a comparison of pretest and posttest responses for DVT, along with the statistical variance between the mean scores. In the pretest, students' information form for DVT exhibited a mean score of 20.21 ± 8.97 (minimum=0, maximum=36), while the posttest mean score was 26.75 ± 6.9 (minimum=10, maximum=36). Respondents who affirmed awareness of DVT increased from 62.2% in the pretest to 74.4% in the posttest. Regarding the statement "I can understand if a patient has developed DVT", 51.1% answered "partially", and 30% answered "no" in the pretest, compared to 57.8% "partially" and 8.9% "no" in the posttest.

Similarly, responses to the statement "I know what should be done so that DVT does not develop" showed a shift from 37.8% "partially" and 31% "no" in the pretest to 42.2% "partially" and 5.6% "no" in the posttest. Concerning awareness of the effect of leg elevation, 40% responded "no" in the pretest, decreasing to 2.2% in the posttest.

Awareness of the effect of range of motion (ROM) exercises on preventing DVT increased from 13.3% in the pretest to 40% in the posttest. Participants affirming knowledge of how to perform ROM exercises rose from 6.7% in the pretest to 34.4% in the posttest. Responses to the statement "I know the effect

TABLE 2: DVT information form pre-test/post-test mean score.

Evaluation of DVT knowledge, attitude, and practices	Pre-test			Post-test			p*
	Yes n (%)	Partially n (%)	No n (%)	Yes n (%)	Partially n (%)	No n (%)	
1. I know what DVT is	56 (62.2)	25 (28.8)	9 (10.0)	67 (74.4)	22 (24.4)	1 (1.1)	>0.05
2. I know why DVT develops	41 (45.6)	32 (35.6)	17 (18.8)	61 (67.8)	28 (31.1)	1 (1.1)	<0.05
3. I can understand if a patient has developed DVT	17 (18.9)	46 (51.1)	27 (30.0)	30 (33.3)	52 (57.8)	8 (8.9)	<0.05
4. I know what should be done so that DVT does not develop	28 (31.1)	34 (37.8)	28 (31.1)	47 (52.2)	38 (42.2)	5 (5.6)	<0.05
5. I know the effect of weight on DVT	48 (53.3)	28 (31.1)	14 (15.6)	58 (64.4)	21 (23.3)	11 (12.2)	>0.05
6. I know the effect of smoking on DVT	57 (63.3)	15 (16.7)	18 (20.0)	62 (68.9)	24 (26.7)	4 (4.4)	<0.05
7. I know the effect of exercise or movement on DVT	57 (63.3)	21 (23.3)	12 (13.3)	70 (77.8)	15 (16.7)	5 (5.6)	>0.05
8. I know the effect of leg elevation on preventing DVT	34 (37.8)	20 (22.2)	36 (40.0)	71 (78.9)	17 (18.9)	2 (2.2)	<0.05
9. I know the effect of ROM exercises on preventing DVT	12 (13.3)	26 (28.9)	52 (57.8)	36 (40.0)	30 (33.3)	24 (26.7)	<0.05
10. I know how to do ROM exercises	6 (6.7)	26 (28.9)	58 (64.4)	31 (34.4)	31 (34.4)	28 (31.1)	<0.05
11. I know the effect of nutrition on the prevention of DVT	43 (47.8)	32 (35.6)	15 (16.7)	61 (67.8)	24 (26.7)	5 (5.6)	<0.05
12. I know the effect of vitamin K on DVT	30 (33.3)	25 (27.8)	35 (38.9)	42 (46.7)	32 (35.6)	16 (17.8)	<0.05
13. I know postoperative DVT and its significance	28 (31.1)	29 (32.2)	33 (36.7)	37 (41.1)	33 (36.7)	20 (22.2)	>0.05
14. I know what anticoagulant drugs are and their effect on DVT	46 (51.1)	26 (28.9)	18 (20.0)	54 (60.0)	33 (36.7)	3 (3.3)	<0.05
15. I know about anticoagulant (blood thinner) foods	32 (25.6)	39 (43.3)	19 (21.1)	54 (60.0)	33 (36.7)	3 (3.3)	<0.05
16. I have knowledge of what to pay attention to when using blood thinners	44 (48.9)	31 (34.4)	15 (16.7)	59 (65.6)	26 (28.9)	5 (5.6)	<0.05
17. I know the effect of compression elastic stockings on DVT	50 (55.6)	15 (16.7)	25 (27.8)	59 (64.4)	23 (25.6)	9 (10.0)	<0.05
18. I know how to put on and take off the elastic compression socks	35 (38.8)	21 (23.3)	34 (37.8)	54 (60.0)	21 (23.3)	15 (16.7)	<0.05
The pre-test/post-test mean score of the students' information form for DVT	X±SD (minimum-maximum) 20.21±8.97 (0-36)			X±SD (minimum-maximum) 26.75±6.9 (10-36)			

*Chi-square test in dependent groups; DVT: Deep vein thrombosis; ROM: Range of motion; SD: Standard deviation.

of vitamin K on DVT” indicated a rise from 33.3% in the pretest to 46.7% in the posttest. Awareness of post-operative DVT and its significance increased from 31.1% in the pretest to 41.1% in the posttest.

Regarding familiarity with anticoagulant (blood thinner) foods, respondents answering “yes” increased from 25.6% in the pretest to 60% in the posttest. Knowledge about putting on and taking off elastic compression socks showed an increase from 38.8% in the pretest to 60% in the posttest. Notably, no statistically significant difference was observed in the answers to questions 1, 4, 7, and 13 in both the pretest and posttest ($p>0.05$) (Table 2).

As seen in Table 3, there was a significant difference between the pre-and post-education DVT knowledge scores of the students ($p<0.05$) (Table 3).

Table 4 presents the impact of specific sociodemographic characteristics of students on their access to distance education. Participants who lacked sufficient internet quota on their personal or public computers encountered challenges in the online education process, and this difference was statistically significant ($p<0.05$) (Table 4).

Table 5 shows the satisfaction levels of students in online education. A notable 83.9% of the students considered the teaching materials to be adequate, while 87.9% expressed satisfaction with the online education provided through DVT (Table 5).

DISCUSSION

The global impact of the COVID-19 pandemic has been profound across educational, economic, and social spheres, particularly within the health sector. In response to the pandemic, traditional face-to-face training was halted, prompting a shift to online education. The evolution of virus variants influenced educational strategies, leading to significant pedagogical considerations. To ensure educational continuity, alternative systems were introduced, and the widespread use of the internet, coupled with infrastructure changes, played a crucial role in the dissemination of digital and web-based education.^{16,17} Throughout the pandemic, the conventional time and location constraints of traditional education were replaced by a more flexible environment, facilitated by the widespread adoption of web-based online educa-

TABLE 3: Comparison of students' pre-test/post-test DVT mean scores.

	n	\bar{X} (SD)	t	SD	p value
Pre-test	90	20.21 (8.97)	-6.021	10.31	0.00
Post-test	90	26.7 (6.93)			

t: Independent groups t-test; DVT: Deep vein thrombosis; SD: Standard deviation.

TABLE 4: The effect of certain sociodemographic characteristics of students on access to distance education.

	Experiencing barriers to accessing distance education		p value
	Yes/n (%)	No/n (%)	
Having a personal or public computer in the distance education process			
Yes	9 (19.6)	43 (32.4)	<0.05
No	25 (14.4)	13 (23.6)	
Possibility of purchasing and using the Internet			
Yes	24 (28.3)	51 (46.7)	<0.05
No			

TABLE 5: Students' online education satisfaction level.

	Yes (n/%)	No (n/%)
Finding the learning material on the subject sufficient	76 (83.9)	14 (16.1)
Finding the online training provided sufficient and feeling satisfied	79 (87.9)	11 (12.1)

tion. Digital education and web-based platforms played a pivotal role in sustaining the level and quality of learning. In an effort to curb the spread of COVID-19 in Türkiye, face-to-face education in all educational institutions was suspended on March 25, 2020. Schools transitioned to online education for the remainder of the spring semester in the 2019-2020 academic year, a practice recommended by the ministry of health to continue during the ongoing epidemic.¹⁶⁻¹⁹ Clinical practices, vital for healthcare professionals' education, faced suspension due to pandemic-related isolation. The shift towards evidence-based practice involved delivering theoretical knowledge through online courses, prompting health educators to draw comparisons between face-to-face and online education. Venous thromboembolism prophylaxis, a critical evidence-based application in healthcare, was chosen as a focal point for research. Given its significance in post-heart attack and stroke scenarios, a quasi-experimental study with a pre-test-post-test design was conducted to assess the impact of web-based education on the knowledge levels of university students studying health. Due to the limited literature on the effectiveness of online training for DVT, the study's findings on knowledge levels were internally discussed. Additionally, the effectiveness of online education was explored by comparing findings with existing literature, considering both face-to-face and online training.^{2,20,21} Research by Karaman and Eygü on distance education revealed that a majority of students possessed personal computers at home, with a moderate level of usage. They observed a relationship between students' daily computer usage time and their perceptions of adopting and evaluating technology. In contrast, our research indicated that nearly half of the students had access to a personal or public computer during distance education, and most encountered no difficulties in obtaining internet access.²² Given that the research sample comprised university students, approximately 20 years old, aligning with the existing literature, a study by Yüksekdağ Boz involving nurses found that the age factor had a more pronounced impact on the perception of distance education among young nurses.¹⁴ Due to advancements in contemporary technology, everyday life continues to integrate innovative prod-

ucts. The influence of age on adapting to technological tools and innovations within the education sector is believed to be significant, prompting the need for further research. Literature underscores the importance of early mobilization and leg elevation for preventing DVT and facilitating swift recovery post-surgery.²³ Al-Mugheed and Bayraktar's study on nurses' knowledge and practices regarding DVT prophylaxis revealed that a majority of nurses provided incorrect answers to statements such as "Foot and leg exercises can prevent DVT" and "Bed rest is required after major surgery to prevent DVT", indicating a low level of DVT knowledge among the nurses.² In our study, a pre-test-post-test analysis showed no significant difference in responses to questions like "I know the effect of exercise and movement on DVT" and "I know about post-operative DVT and its significance." This suggests that students already possessed a high level of knowledge on these topics even before receiving formal education. Despite venous thromboembolism being the most common preventable cause of hospital death, a substantial gap exists between our understanding of venous thromboembolism prophylaxis and current medical practice.²⁴ The underlying cause of this discrepancy is attributed to the limited clinical practice resulting from the singular training provided to healthcare professionals. In our study, we posit that the efficacy of measurement tests administered post-education can address clinical gaps and deficiencies. A comparative analysis between online education, with a focus on DVT, and traditional education revealed that while online education did not surpass traditional methods, both groups exhibited an increase in knowledge levels during the post-test.²⁵ In a study conducted, contrasting web-based and traditional learning in the context of a nursing ethics course, concluded that there is insufficient robust evidence to substantiate the advantages of the web-based learning approach. Another study indicated that web-based education, including intra-muscular education, did not significantly enhance students' knowledge and skills but did boost their motivation.²⁶ Aligning with existing literature, our research found that DVT education in a virtual classroom during the COVID-19 period elevated the levels of knowledge, attitude, and practices among students.

LIMITATIONS

Generalization of results is constrained by the single-group design, limited to a specific lecturer's teaching group, constituting the primary research limitation.

CONCLUSION

The prevalence of online education in universities has been steadily rising, gaining significant momentum, particularly over the last decade. Similar to traditional education, online learning presents both advantages and disadvantages. It is favored for its capacity to provide equal opportunities to individuals unable to attend in-person classes, support lifelong learning, and offer flexibility in terms of location and scheduling, among other benefits.¹⁷ In our study, we determined that online education for students in the health field, specifically focusing on DVT with its high mortality rate, resulted in an increased level of knowledge among the students. The materials utilized were deemed sufficient, and overall, the students expressed satisfaction with the online educational experience. While there has been a growing body of research on online education, particularly in recent times, few

studies have specifically investigated DVT prophylaxis for students, nurses, and healthcare professionals. Consequently, we recommend further research on online education and its integration with clinical practice in the context of DVT prophylaxis.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Esra Özkan, Canan Sarı; **Design:** Esra Özkan, Canan Sarı; **Control/Supervision:** Esra Özkan, Canan Sarı; **Data Collection and/or Processing:** Esra Özkan; **Analysis and/or Interpretation:** Esra Özkan; **Literature Review:** Esra Özkan, Canan Sarı; **Writing the Article:** Esra Özkan, Canan Sarı.

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