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Forensic Case and Forensic Evidence Management Training: Paramedic Student Example

Adli Vaka ve Adli Delil Yönetimi Eğitimi: Paramedik Öğrenci Örneği

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Öz

Amaç: Bu çalışmanın amacı paramedik öğrencilerine adli vaka ve delil yönetimi eğitimi vermek ve eğitimin öğrencilerin bilgi düzeyine etkisini değerlendirmektir.

Yöntem: Çalışma ön test-son test yarı deneysel modelde tasarlanmıştır. Araştırmanın örneklemini 2023/2024 akademik yılında Türkiye'deki bir üniversitenin İlk ve Acil Yardım Programı 1. ve 2. sınıfında öğrenim gören 144 gönüllü paramedik öğrencisi oluşturmuştur. Veriler, eğitimden önce ve sonra uygulanan bir anket formu kullanılarak toplanmıştır. Olay Yeri Adli Delil Yönetimi Eğitimi teorik bilgi ve vaka çalışmalarını içermektedir. Veriler SPSS 29.0 programı kullanılarak analiz edilmiştir.

Bulgular: Öğrencilerin eğitim öncesi bilgi puan ortalaması 13.82 ± 3.55 iken, eğitim sonrasında bu puan 21.38 ± 2.13'e yükselmiştir. Eğitim öncesi ve sonrası bilgi puanları arasındaki fark istatistiksel olarak anlamlıdır. Eğitim sonrasında öğrencilerin adli vaka olarak rapor edilmesi gereken durumları doğru tespit etme oranı %88,9'dan %99,3'e yükselmiştir. Olay yerinde delil olarak değerlendirilebilecek bulguları doğru tespit etme oranı ise eğitim sonrasında %100'e ulaşmıştır. Eğitim, öğrencilerin ateşli silah yaralanmaları, ası vakaları ve cinsel istismar vakalarında adli delil yönetimi konusundaki bilgi düzeylerini önemli ölçüde artırmıştır.

Sonuç: Özellikle ateşli silah yaralanmaları, asılma ve cinsel saldırı vakaları gibi spesifik adli vakalarda bilgi düzeyindeki artış dikkat çekicidir. Bu durum, bu tür eğitimlerin paramediklerin adli vakalara daha doğru ve bilinçli bir şekilde müdahale etmelerini sağlayacağını göstermektedir.

Anahtar Kelimeler: Paramedik, Öğrenci, Eğitim, Adli vaka, Delil zinciri, Olay yeri

Abstract

Aim: This study aimed to provide forensic case and evidence management training to paramedic students and to evaluate the effect of the training on the knowledge level of the students.

Methods: The study was designed as a pretest/posttest quasi-experimental model. The study sample consisted of 144 volunteer paramedic students studying in the 1st and 2nd year of the First and Emergency Aid Program of a university in Turkey in the 2023/2024 academic year. Data were collected using a questionnaire form administered before and after the training. Crime Scene Forensic Evidence Management Training includes theoretical knowledge and case studies. Data were analyzed using the SPSS 29.0 program.

Results: The mean knowledge score of the students before the training was 13.82 ± 3.55, while this score increased to 21.38 ± 2.13 after the training. The difference between pre-and post-training knowledge scores was statistically significant. After the training, the rate of students correctly identifying situations that should be reported as forensic cases increased from 88.9% to 99.3%. The rate of correctly identifying the findings that can be considered as evidence at the crime scene reached 100% after the training. The training significantly increased the students' level of knowledge on forensic evidence management in cases of gunshot injuries, hanging, and sexual abuse.

Conclusion: The increase in the level of knowledge in specific forensic cases, such as gunshot injuries, hangings, and sexual assault, is particularly noteworthy. This situation suggests that this typ of training may enable paramedics to intervene in forensic cases more accurately and consciously.

Keywords: Paramedic, Student, Training, Forensic case, Chain of evidence, Crime scene

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INTRODUCTION

It is the responsibility of first responders to identify a forensic event and to manage the evidence at the crime scene. Since forensic cases usually require emergency medical intervention, paramedics are among the first teams to arrive at the crime scene (1,2). Paramedics are legally responsible for reporting the forensic event and the preserving evidence in pre-hospital forensic cases (Turkish Penal Code, Article 280, Law no: 5237, Acceptance: 26.09.2004). Studies suggest that healthcare professionals do not have sufficient knowledge about prehospital forensic case reporting and forensic evidence management (2,4,5). Paramedics who do not know how to manage forensic cases and evidence can cause evidence to be corrupted, lost, or contaminated when providing emergency health services. Forensic case management is critical to the justice process. Therefore, paramedics must have adequate training and awareness to be able intervene in forensic cases correctly(6).

In this direction, it was aimed to raise awareness about the approach to forensic cases and the chain of evidence by providing crime scene forensic evidence management training to paramedic students and to evaluate the effect of the training on the knowledge level of the students.

MATERIALS AND METHODS

The study was designed as a pretest/posttest quasi-experimental model. The study population was composed of 225 paramedic students studying in the 1st-year and 2nd-year of the First and Emergency Aid Program of a university in Turkey during the 2023/2024 academic year. Taro Yamane formula was used to calculate the sample size of the study. Accordingly, out of 225 students in the population, the sample size was determined to be at least 144 to ensure a 95% confidence level.

The data for the study were collected between May 2024 and June 2024. The students included in the study were given a data collection form before and after the training. The Crime Scene Forensic Evidence Management training, which included theoretical knowledge and the presentation of sample cases, was completed for 144 volunteer participants. The content of the training included topics such as forensic incidents, evidence, crime scene management, and evidence management, as well as the roles and responsibilities of paramedics in forensic cases such as injuries, violence, abuse, sexual assault, and suicide. Training was given to four groups of 35-37 students in each group in the classroom environment in two class hours (30+30 minutes + 1 break). Trainings were given by a single lecturer to avoid bias and ensure standardization.

The form used as a data collection tool consisted of two parts. The first part of the form consisted of four questions to determine the introductory characteristics. In the second part, there were 24 multiple-choice questions about forensic cases and evidence (three questions), roles and responsibilities of paramedics in forensic cases (3), crime scene security (2), and evidence management in pre-hospital forensic cases (16 questions). The researchers developed the data collection form in line with the literature (4,7,8). There was one correct answer for each question. Participants could score a minimum of 0 and 24 points from 24 items. The questions created by the researchers were sent to eight experts (four paramedics, two forensic medicine experts, and two judicial police) for expert opinion. In line with the suggestions of eight experts, the data collection form was finalized. The Content Validity Index (CVI) value for expert opinions was determined as 0.84.

Data were analyzed using the Statistical Package for Social Sciences (SPSS) 29.0 Windows software program, and the statistical significance value was accepted as $p < 0.05$. The normality distributions of the mean scores in

the knowledge assessment form were analyzed using the skewness and kurtosis tests (−1 to +1) (9), and the tests showed a normal distribution. The skewness value of the participants' forensic evidence evaluation score difference was 0.058, and the kurtosis value was -0.484. Frequency, percentage, arithmetic mean, standard deviation, and t-test were used in the analysis of the data.

The approval of the Ethics Committee of the relevant university (decision no. 2024-3 dated March 27, 2024) and institutional permission were obtained for the study. Written informed consent was obtained from all students who volunteered to participate in the study.

RESULTS

When the demographic characteristics of the paramedic students who participated in the study were analyzed, it was seen that the mean age of the students was 20.45 ± 2.65 years. Among the participants, 75% (n = 108) were female, 25% (n = 36) were male, 49.3% (n = 71) were 1st-year students, and 50.7% (n = 73) were 2nd-year students. While 15.3% (n = 22) of the students encountered a forensic case, and 84.7% (n = 122) did not encounter it (Table 1).

Table 1. Paramedic student's age, gender, class, and forensic case encounter status

Characteristic	**Mean ± SD**
Age	20.45 ± 2.65
	n (%)
Gender	
Female	108(75%)
Male	36(25%)
Class	
1	71(49.3%)
2	73(50.7%)
Encountering a forensic case	
Yes	22(15.3%)
No	122(84.7%)
Total	144(100%)

The mean scores of the students from the test evaluating their knowledge before and after the crime scene forensic evidence management training are shown in Table 2. The total mean score was 13.73±3.83 before the training and 21.34±2.27 after the training. When the mean scores of paramedic students before and after crime scene forensic evidence management training were compared, a statistically significant increase ($p < 0.05$) was observed, and the effect size was calculated as 2.58 (very high effect).

Table 2. Comparison of paramedic students' knowledge average scores before and after forensic evidence management training

Knowledge Scores	Pre-test	Post-test	Statistical Analysis	Pre-/Post-Effect Size (Cohen's d)
	$\bar{X}$±SD	$\bar{X}$±SD		
Total Score	13.82±3.55	21.38±2.13	$P < 0.001$	2.58

t-test, SD standard deviation, effect size (Cohen's d)
*$p < 0.05$

Table 3 shows the distribution of students' recognition of forensic cases and evidence, and their knowledge of their duties and responsibilities in forensic cases before and after the training. According to the table, the cases that should be reported as forensic cases were correctly defined by 81.9% of the students before the training and increased to 99.3% after the training. While 88.2% of the students correctly identified the forensic evidence found at the crime scene before the training, this rate increased to 100% after the training. The proportion of students who correctly defined the duty of a paramedic in a forensic case increased from 56.9% before the training to 84% after the training (Table 3).

Table 4 shows the distribution of the results of the questions related to evidence management in forensic wounds before and after the training. According to the table, while 37.7% of the students before the training stated that forensic wounds should not be washed with saline to preserve evidence, this rate increased to 91% after the training. While 66.7% of the students before the training knew that wound dressing materials used during emergency medical aid intervention should be preserved

Table 3. Distribution of paramedic students' knowledge about forensic cases and evidence and their duties in forensic cases before and after education (n=144)

Variables	Result	Pre-education		Post-education	
		n	%	n	%
Which of the following must be reported as a forensic case?	Correct	118	81.9	143	99.3
	Incorrect	26	18.1	1	0.7
What kind of evidence can be found at the scene?	Correct	127	88.2	144	100
	Incorrect	17	11.8	0.0	0.0
Which of the following are among the duties of the paramedics in forensic cases?	Correct	82	56.9	121	84.0
	Incorrect	62	43.1	23	16.0

as evidence, this rate increased to 91% after the training. Before the training, 38.2% of the students knew that all invasive procedures (intubation, intravenous catheter, etc.) performed for therapeutic purposes in a forensic case of death should be left on the patient. This rate increased to 82.6% after the training (Table 4).

Table 4. Distribution of paramedic students' results to questions about evidence management in forensic wounds before and after training (n=144)

Variables	Result	Pre-educatio		Post-education	
		n	%	n	%
Which of the statements about the care of forensic wounds is correct?	Correct	54	37.7	131	91.0
	Incorrect	90	62.5	13	9.0
Which of the statements about dressing forensic wounds is correct?	Correct	96	66.7	131	91.0
	Incorrect	48	33.3	13	9.0
Which of the following statements about all invasive procedures performed for therapeutic purposes in a forensic case where medical intervention is performed but death occurs is correct?	Correct	55	38.2	119	82.6
	Incorrect	89	61.8	25	17.4

Table 5 shows the distribution of the results before and after the training for the questions related to forensic evidence management in cases of gunshot injuries and hanging. While 36.1% of the students before the training knew that the clothes should be cut at the seams in gunshot injuries, this rate increased to 73.6% after the training. While 6.9% of the participants before the training knew that the clothes removed from the patient for intervention in firearm injuries should be kept in paper packages, this rate increased to 74.3% after the training. In cases where the firearm needs to be removed from its location, it was answered correctly by 81.3% before the training and 98% after the training that the position of the firearm can be changed by grasping both sides of the pistol grip with a gloved hand. Before the training, 54.9% of the students knew that if the patient is alive, the patient should be rescued by cutting the rope between the hanging point and the knot, while this rate increased to 97.9% after the training (Table 5).

Table 5. Distribution of paramedic students' responses to questions about forensic evidence management in gunshot injuries and hanging cases before and after training (n=144)

Variables	Result	Pre-education		Post-education	
		n	%	n	%
How should the forensic case's clothes be removed for medical attention in case of gunshot injuries?	Correct	52	36.1	106	73.6
	Incorrect	92	63.9	38	26.4
In case of gunshot injuries, what should the clothes cut from the patient be kept in?	Correct	10	6.9	107	74.3
	Incorrect	134	93.1	37	25.7
A firearm is standing next to the patient, and it is an obstacle to intervening in the patient, which is the right thing to do?	Correct	117	81.3	141	98.0
	Incorrect	27	18.7	3	2.0
If a person is found hanging and alive, how should the emergency medical team lower the patient?	Correct	79	54.9	141	97.9
	Incorrect	65	45.1	3	2.1

Table 6 shows the distribution of responses to questions about forensic evidence management in cases of sexual abuse before and after the training. While 43.8% of the students knew that the entire urine sample of the sexual abuse victim who is unable to hold urine should be taken

in a sterile container before the training, this rate increased to 91.7% after the training. The fact that the victim of sexual assault should not be allowed to eat, drink, gargle, brush teeth, and wash and clean was answered correctly by 71.5% of the students before the training and 96.5% after the training. While 16% of the students before the training knew that the hands of the victim of sexual assault should be wrapped in paper packages to protect the evidence, this rate increased to 88.9% after the training (Table 6).

Table 6. Distribution of paramedic students' results to questions about forensic evidence management in cases of sexual abuse before and after training

Variables	Result	Pre-education		Post-education	
		n	%	n	%
In a case of alleged sexual abuse, what should be done if the victim states that she needs to urinate and is incontinent?	Correct	63	43.8	132	91.7
	Incorrect	81	56.2	12	8.3
Which of the statements about the protection of forensic evidence in cases of sexual assault is correct?	Correct	103	71.5	139	96.5
	Incorrect	41	28.5	5	3.5
The victim says that he/she scratched the attacker, what should be done to preserve the evidence?	Correct	23	16.0	128	88.9
	Incorrect	121	84.0	16	11.1

DISCUSSION

This study shows the effect of crime scene forensic evidence management training on the knowledge level of paramedic students regarding forensic evidence management. In our study, the mean score of paramedic students' knowledge about forensic cases and evidence management was 13.82±3.55 before and 21.38±2.13 after the training (Table 2). This difference shows that the crime scene forensic evidence management training given to paramedic students was effective. Previous studies show that although the rate of ambulance personnel receiving training on forensic case management varies, it is generally inadequate (1,4,6,7,8,10). In Turkey, in 2015, the Protocol on Training and Cooperation on the Approach of Emergency Health Care Professionals to Material Evidence in Forensic Cases was signed in order not to obscure the evidence during medical intervention (11). A previous study reported that 57% of ambulance staff received in-service training in this context, but 70% of those who received training did not find this training sufficient (6). This situation reveals that the number and quality of training provided to recognize and manage forensic cases should be increased.

Low forensic awareness of first responders (112 health workers, firefighters, etc.) at the scene is a risk factor for the forensic process (2). Healthcare personnel who are not informed about this issue do not act skeptically. While providing emergency health services, they do not report a forensic case because they do not know whether the dead or injured person is a forensic case or not (4,7). The Turkish Penal Code stipulates that health personnel who fail or delay in reporting to the competent authorities evidence of a crime committed during their duties shall be punished with imprisonment of up to one year (Turkish Penal Code, Article 280, Law no: 5237, Acceptance: 26.09.2004). In our study, while 88.9% of paramedic students correctly identified the situations that should be reported as forensic cases before the training, this rate was determined as 99.3% after the training. Although the training period in our study was short, the high rate of students correctly identifying forensic evidence shows us that our training was effective. The main reason for this high rate is the effect of utilizing sample forensic cases in the training content. Paramedics encounter a wide variety of forensic cases that require specific knowledge before hospitalisation. Studies including paramedics reported that more than half of the ambulance staff had problems identifying forensic cases (6). In another study, 36.8% of ambulance personnel stated they had difficulties recognizing a forensic case, and 73.5% had never reported it (7). Forensic case reporting rates may

be associated with the lack of knowledge of ambulance staff about forensic cases. Although the rate of recognition of forensic cases by ambulance personnel varies from case to case and according to their level of education, there is generally a lack of knowledge and skills in this regard. It is essential to organize more comprehensive and qualified training to improve the skills of health workers in recognizing and managing forensic cases. Therefore, integrating forensic cases, forensic evidence, and crime scene management into paramedic training curricula and updating information through regular in-service training is essential.

The first step in the collection and maintenance of evidence is its identification (7). The correct identification of forensic evidence plays a critical role at every stage of the legal process and is indispensable for the administration of justice. Hence, all teams (especially healthcare professionals) present at the forensic scene must be aware and trained in identification and preservation of evidence. A previous study shows that 58% of ambulance personnel cannot protect forensic evidence at the scene (6). This finding shows us that the knowledge level of ambulance staff is insufficient in recognizing forensic evidence, and thus, they cannot identify potential evidence. In our study, all of the paramedic students (100%) correctly identified the evidence that could be considered as evidence at the forensic scene after the training. This situation may be associated with the rich content of the training.

Paramedics should know their roles and responsibilities in forensic cases. The primary duty of a paramedic in a forensic case is to provide emergency medical intervention. While fulfilling this duty, acting with awareness of the forensic nature of the scene, taking care to protect the evidence, and collaborating with the relevant authorities are among the essential responsibilities of the paramedic (6). In the Turkish Penal Code, it is stated that "Destroying, erasing, concealing, altering or distorting the evidence of a crime will be punished with imprisonment" (Turkish Penal Code, Article 281, Law no: 5237, Acceptance: 26.09.2004). Paramedics who do not know their duties and responsibilities may act against the law and face legal problems. Our study determined that 84% of paramedic students correctly defined their duties in forensic cases after training. In a survey conducted by Doğan et al. (2013) with paramedic students, this rate was 83.3%, parallel with our study (10). The responsibilities of paramedics regarding forensic evidence management may vary according to the country's legal regulations, institutional policies, and individual competencies. The main goal should always be to protect the patient's health and, at the same time, contribute to the the proper functioning of the judicial process.

Healthcare personnel need to be meticulous during emergency medical intervention to distinguish between therapeutic interventions and forensic injuries (12). In our study, we examined the level of knowledge of paramedic students about managing therapeutic interventions by preserving forensic evidence. After the training, 91% of the students learned that "the wound site should not be washed in forensic cases" and "wound dressing materials should be kept as forensic evidence". Wounds should not be washed to preserve evidence such as gunshot residue, blood, body fluids, and scars, which may be critical for forensic investigations. In addition, dressing materials are important as they may contain potential evidence from the crime scene. For this reason, ambulance personnel at the scene should properly preserve these materials and deliver them to the competent judicial authorities (13). Before the training, only 38.2% of the students knew that all invasive procedures (intubation, intravenous catheter, etc.) should not be removed from the patient in a case that could not be saved despite all medical interventions. This rate increased to 82.6% after the training (Table 4). In patients who

cannot be saved despite all interventions, all procedures performed for therapeutic purposes should not be removed from the patient. This is a critical practice for the correct and complete conduct of the forensic investigation, the preservation of forensic evidence, the preservation of evidence of medical intervention, and the clarification of the cause of death (13). High knowledge and awareness of healthcare personnel on this issue will make a significant contribution to the correct functioning of the forensic process (12,14,15).

Gunshot injuries are the most common (87.3%) forensic cases known by emergency health services personnel (16). Paramedics are the healthcare personnel who frequently encounter these cases and provide emergency aid services. Ambulance workers are mostly aware of the forensic nature of firearm injuries. However, deficiencies related to evidence preservation and crime scene management have been reported (2,4). In our study, the answers to the questions related to preserving and recording evidence in gunshot injuries were analyzed. While 36.1% of the students before the training knew that clothes should be cut at the seams in gunshot injuries, this rate increased to 73.6% after the training. In Gülekçi's (2024) study, it was reported that this question was answered correctly by 79.8% of the students and 81% of those who were actively employed. In this study, it is thought that the frequent encounter of healthcare personnel with gunshot injuries increased their awareness of this issue (4). Before the training, 6.9% of the participants knew that the clothes cut in gunshot wounds should be stored in paper packages, while this rate was 74.3% after the training. It is thought that training such as the one in our study will be effective in gaining knowledge on the subject. In Gülekçi's (2024) study, 78.7% of the students and 88.1% of the staff could not answer this question correctly (4). It should be kept in mind that the failure of ambulance personnel to preserve the evidence correctly in gunshot injuries will cause deterioration of the evidence and negatively affect the forensic process. In our study, the question about removing the firearm from the forensic scene was answered correctly by 98% after the training (the firearm should be kept in a safe place by grasping both sides of the pistol grip with two fingers with a gloved hand). A study conducted with emergency health personnel reported that 44.4% of the students and 49.5% of the healthcare personnel answered the question correctly (4). Although firearm injuries are cases that healthcare professionals frequently encounter and have a high level of awareness, it is seen that there is a need for training in cases that require specific knowledge.

It should not be forgotten that hanging cases may occur as a result of suicide attempts or murder. For this reason, the hanging knot is essential evidence in hanging cases. In hanging cases, the rope should be cut between the hanging point and the knot to preserve evidence (13). The question of how the emergency health team should lower the patient in the intervention to the case of hanging alive was answered correctly by 54.9% of the students before and 97.9% after the training. In one study, a significant proportion of students (44.9%) and health professionals (43.8%) answered this question incorrectly (4). It is thought that these low rates may be since healthcare workers who are not pre-hospital emergency care personnel do not encounter cases of hanging. Our study findings show that training that includes sample forensic cases requiring specific knowledge contributes to creating awareness.

Although sexual abuse is frequently experienced in Turkey and the world, it is known that most of the cases are not reported. According to World Health Organisation data, it is stated that one out of every three women is exposed to sexual assault (17). In our study, when the answers of the students to the questions about the protection of evidence in rape cases were examined, 43.8% of the students knew that the entire urine sample of the sexual abuse victim

who is unable to hold urine should be taken in a sterile container before the training, this rate increased to 91.7% after the training. Especially in cases of sexual abuse, urine may contain necessary biological evidence such as sperm, seminal fluid, or other body fluids. Urinary retention means that this evidence may not yet be lost. Therefore, a medically appropriate and safe method should be used for urine sampling (13). The fact that the victim of sexual assault should not be allowed to eat, drink, gargle, brush teeth, and wash and clean was answered correctly by 71.5% of the students before the training and 96.5% after the training. In the case of sexual assault, sperm, saliva, and other body fluids are potential biological evidence. Actions leading to this potential evidence's spoliation should be prevented. While the priority is to stabilize the patient's medical condition, the preservation and proper collection of potential evidence at the scene and on the patient's body is vital for the forensic process. While 16% of the students before the training knew that the hands of the victim who scratched the attacker should be wrapped in paper packages to protect the evidence on the hands, this rate increased to 88.9% after the training. The primary purpose of wrapping hands with paper is to protect potential evidence (gunshot residues, biological materials, etc.) that may be found on the hands in forensic cases. Paper bags are preferred because paper retains minimal moisture, reducing the risk of evidence deterioration (13,14,18). In a study, the majority of healthcare professionals (53.3%) and students (58.4%) stated that hands should be wrapped in plastic evidence bags to protect the evidence (4).

Sawyer et al. (2017) stated that although Australian paramedics frequently encountered rape cases, they did not have adequate training or formal preparation to manage these situations (19). In a study conducted in South Africa, it was determined that pre-hospital emergency care providers lacked knowledge and skills in the management of rape victims, and a multidisciplinary guideline was needed (20). Turkey has policies and protocols for the management of forensic evidence. However, the difficulties encountered in practice and the deficiencies in the knowledge level of the staff reveal the need for continuous improvement and development efforts in this field.

CONCLUSION

The study shows that forensic case and evidence management training significantly increased the knowledge level of paramedic students. It was found that students showed significant improvement in recognizing situations that should be reported as forensic cases, correctly identifying evidence at the scene, and understanding their duties in forensic cases. The increase in the level of knowledge in specific forensic cases, such as gunshot injuries, hangings, and sexual assaults is particularly noteworthy. This situation suggests that such training may enable paramedics to intervene in forensic cases more accurately and consciously.

The study emphasizes that increasing the forensic awareness of paramedic students during their formal education is essential for the correct functioning of forensic processes. It has been shown that uneducated health care personnel may be inadequate in reporting forensic cases and forensic evidence management, and this training can reduce this risk.

Declarations

Conflict of Interest

The authors declare that they have no conflict of interest related to this article.

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KAYNAKLAR

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