

Assessing the Performance of ChatGPT in Addressing Questions Regarding Urethral Strictures a Cross Sectional Study

Üretral Darlıklarla İlgili Sorulara Yanıt Vermede ChatGPT'nin Performansının Değerlendirilmesi Üzerine Kesitsel Bir Çalışma

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ABSTRACT Objective: ChatGPT is an artificial intelligence program with natural language processing. In this study, we aimed to evaluate the accuracy and reproducibility of ChatGPT's answers to frequently asked questions (FAQs) about urethral strictures. **Material and Methods:** FAQs about urethral strictures on the websites of urological associations and medical establishments were analyzed. Also, strong recommendation-level information was gathered from the urethral strictures section of the European Association of Urology (EAU) 2022 Guidelines. All questions were asked in order in ChatGPT August 3rd version. All answers were evaluated separately by two specialist urologists and scored between 1-4. Where 1: completely correct, 2: correct but insufficient, 3: combination of accurate and misleading information, and 4: completely incorrect. This study was conducted in accordance with the principles of the Declaration of Helsinki. **Results:** Of the FAQs, 89.5% were answered completely correctly. No question was answered completely incorrectly. All questions about general information, prevention and complications were graded as 1. Of the 45 questions prepared according to the EAU guideline recommendations, 34 (75.6%) were evaluated as Grade 1, and 5 (11.2%) and 3 (6.6%) as Grade 3 and 3 (%6.6) as Grade 4. All questions related to general information, prevention and complications received the same answer the second time they were asked. **Conclusion:** Our findings demonstrated that ChatGPT accurately and satisfactorily answered majority of the questions about urethral strictures. Although it has limitations, ChatGPT is predicted to have an important position in the health sector as it is a constantly evolving platform.

Keywords: Artificial intelligence; knowledge; urethral stricture

ÖZET Amaç: ChatGPT, doğal dil işleme özelliğine sahip bir yapay zekâ programıdır. Bu çalışmada, üretra darlıkları hakkında sık sorulan sorulara (SSS) ChatGPT'nin verdiği yanıtların doğruluğunu ve tekrarlanabilirliğini değerlendirmeyi amaçladık. **Gereç ve Yöntemler:** Üroloji dernekleri ve tıbbi kuruluşların web sitelerinde üretra darlıkları hakkında SSS analiz edildi. Ayrıca Avrupa Üroloji Derneği [(EAU) 2022 Kılavuzunun üretral darlıklar bölümünden öneri düzeyinde güçlü bilgiler toplanmıştır. ChatGPT 3 Ağustos versiyonunda tüm sorular sırasıyla soruldu. Tüm cevaplar 2 uzman ürolog tarafından ayrı ayrı değerlendirilerek 1-4 arasında puanlandı. Burada 1: Tamamen doğru, 2: Doğru ama yetersiz, 3: Doğru ve yanıltıcı bilgilerin kombinasyonu ve 4: Tamamen yanlış. Bu çalışma, Helsinki Deklarasyonu prensiplerine uygun olarak yapılmıştır. **Bulgular:** SSS'lerin %89,5'i tamamen doğru yanıtlandı. Hiçbir soruya tamamen yanlış cevap verilmedi. Genel bilgiler, korunma ve komplikasyonlarla ilgili soruların tamamı 1 olarak derecelendirildi. EAU kılavuzunun önerileri doğrultusunda hazırlanan 45 sorudan, 34'ü (%75,6) 1. derecede değerlendirildi, 5'i (%11,2) 3. derecede ve 3'ü (%6,6) 4. derecede değerlendirildi. Genel bilgi, önleme ve komplikasyonlarla ilgili tüm sorular, ikinci kez sorulduklarında aynı cevabı aldı. **Sonuç:** Bulgularımız ChatGPT'nin üretral darlıklarla ilgili soruların çoğunluğunu doğru ve tatmin edici bir şekilde yanıtladığını gösterdi. ChatGPT'nin sınırlamaları olsa da sürekli gelişen bir platform olması nedeniyle sağlık sektöründe önemli bir konuma sahip olacağı öngörülmüştür.

Anahtar Kelimeler: Yapay zekâ; bilgi; üretral darlık

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Artificial intelligence, one of the most prominent topics today, is being widely used in all aspects of life.¹ One such sector is the health sector. Chatbots, which are derivatives of artificial intelligence; diseases, such as urethral stricture; disease symptoms; surgical procedures, such as urethroplasty; and many other similar issues, are important tools in terms of their potential to support those who seek guidance and to provide medical information. ChatGPT, introduced by OpenAI and defined as a chatbot, is one of the most heard artificial intelligence in this sector.² Gabriel et al. investigated the use of ChatGPT for patient education and questioning in patients undergoing robotic radical prostatectomy.³

The accuracy and quality of the information provided by these increasingly popular chatbots must be investigated, as patients use platforms, such as the internet, web-based information, and social media tools, for urethral stricture and reconstructive urology. Multiple studies on several branches of urology have investigated the quality of information on the internet and revealed a low quality of this information.^{4,5} ChatGPT is an artificial intelligence system based on reinforcement learning that blends information gathered from several reliable sources, unlike social media platforms and web-based information tools. Therefore, ChatGPT promises to produce consistent and higher-quality answers; however, studies in the literature have reported aspects that cause concern about the authenticity of the data that ChatGPT produces, although it can write reliable scientific studies.⁶ Therefore, we believe that the accuracy of the medical information it provides must be determined.

This study aimed to investigate the reliability and accuracy of ChatGPT's answers to patients' questions about urethral stricture. To the best of our knowledge, this is the first study to be conducted in the literature on this subject.

MATERIAL AND METHODS

We conducted an exhaustive examination of frequently asked questions (FAQs) about urethral strictures, as documented on the official websites of urology associations and medical establishments. The

recommendation tables generated from the European Association of Urology (EAU) 2022 Guidelines, specifically those sections dedicated to the subject of urethral strictures, provided substantial empirical support for the recommendations included in our study.⁷ Within our analysis, unnecessary questions, poorly formed phrases, and inquiries seeking personal opinions were systematically excluded.

Two urologists, proficient in the domain of reconstructive urology, generated the survey questions, which are integral to our research. Subsequently, we presented the inquiries in a methodically structured sequence and documented the ensuing responses using the ChatGPT version as of August 3rd. Each question was systematically posed twice using disparate computing systems to gauge the replicability of responses. The assessment phase comprised two specialist urologists who autonomously reviewed and assessed each response, following a graduated rating scale ranging from 1 to 4. The delineated rating system followed a structured framework 1) denoting responses of complete accuracy, 2) indicating correctness yet insufficient, 3) representing a combination of accurate and misleading information, and 4) signifying entirely incorrect responses.

Cases with a mutual rating upon a specific query by the urologists included formal documentation of a consensus score. Instances of divergent assessments prompted the intervention of a third urologist who was unacquainted with the scores assigned by the preceding evaluators, thereby rendering an impartial evaluation. Queries predicated on the robustly recommended guidelines from the EAU require further scrutiny, thereby appraising their adherence to the stipulated guideline framework. This study did not require approval from the ethics committee because of the absence of patient-associated data.

We performed statistical analyses using Microsoft Excel Version 16, USA. We have expressed the assigned scores corresponding to the provided answers in percentage values. Regarding reproducibility, we categorized responses exhibiting variances in semantic consistency when the identical question was presented negative on distinct computing systems.

This study was conducted in accordance with the principles of the Declaration of Helsinki.

RESULTS

Figure 1 shows a flowchart delineating the selection of questions suitable for study inclusion. Table 1 presents a tabular presentation of data about the responses generated by ChatGPT with inquiries concerning urethral strictures. The total number of evaluated queries was 83, of which ChatGPT accurately and comprehensively addressed 68 (81.9%) queries. Of all responses, 10.8% were correct but insufficient, whereas 3.6% were a confluence of misleading and accurate information. According to FAQs about urethral strictures, the taxonomy of questions was organized along the axes of general information, symptoms and diagnosis, treatment, prevention, and complications. Correspondingly, the rates of completely accurate responses were 100%, 85.7%, 76.9%, 100%, and 100% for each respective category (Supplementary Table 1). Notably, no question had a completely inaccurate response. The distribution of response proficiency in the context of 45 questions drawn from the EAU guideline section dedicated to urethral strictures was 75.6%, 11.2%, 6.6%, and 6.6% in Grades 1-4, respectively (Supplementary Table 2). Figure 2 shows the data regarding response reproducibility. Notably, responses to queries centered on

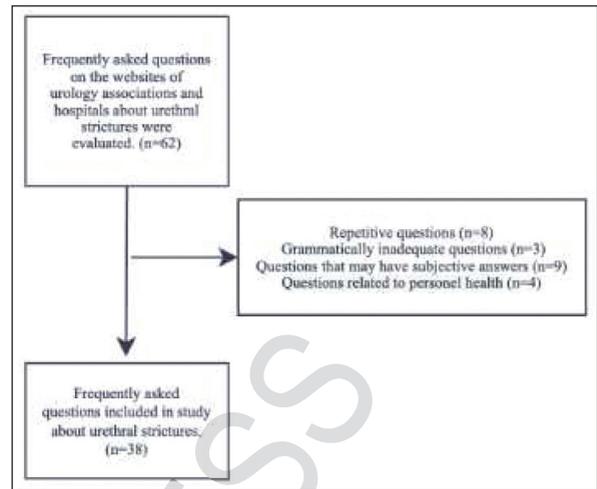


FIGURE 1: Flowchart of questions included in the study.

general information, prevention, and complications exhibited a high degree of similarity. The reproducibility rates for inquiries concerning symptoms and diagnosis, as well as treatment, were 85.7% and 84.6%, respectively. In addition, the inquiries developed following the recommendations provided in the EAU guidelines exhibited a reproducibility rate of 86.7%.

DISCUSSION

Artificial intelligence-supported large language models (LLMs) are one of the most prominent topics

TABLE 1: Grade of responses by the ChatGPT to questions related urethral strictures.

Urethral strictures	Grade 1	Grade 2	Grade 3	Grade 4
Frequently asked questions (n=38)	34 (89.5%)	4 (100%)	-	-
General information (n=9)	9 (100%)	-	-	-
Symptoms and diagnosis (n=7)	6 (85.7%)	1 (14.3%)	-	-
Treatment (n=13)	10 (76.9%)	3 (23.1%)	-	-
Prevention (n=5)	5 (100%)	-	-	-
Complications (n=4)	4 (10.5%)	-	-	-
EAU guideline recommendations (n=45)	34 (75.6%)	5 (11.2%)	3 (6.6%)	3 (6.6%)
Aetiology and prevention (3)	3 (100%)	-	-	-
Diagnosis (n=5)	5 (100%)	-	-	-
Treatment (n=29)	21 (72.4%)	2 (7%)	3 (10.3%)	3 (10.3%)
Tissue Transfer (n=4)	2 (50%)	2 (50%)	-	-
Follow-up (n=4)	3 (75%)	1 (25%)	-	-

Grade 1: Completely correct; Grade 2: Correct but insufficient; Grade 3: Misleading information as well as correct information; Grade 4: Completely incorrect; EAU: European Association of Urology.

SUPPLEMENTARY TABLE 1: Frequently asked questions related urethral strictures.

Frequently asked questions	Final point	Reproducibility
1- What is a urethral stricture?	1	Yes
2- Can urethral strictures be congenital?	1	Yes
3- How are urethral strictures in children diagnosed and treated?	1	Yes
4- What are the differences between male and female urethral strictures?	1	Yes
5- Are urethral strictures more common in males or females?	1	Yes
6- Are there any support groups or resources available for people with urethral strictures?	1	Yes
7- Are urethral strictures associated with prostate problems in men?	1	Yes
8- Can urethral strictures be linked to inflammatory conditions or autoimmune diseases?	1	Yes
9- Can urethral strictures affect women's urinary health during pregnancy?	1	Yes
10- What are the symptoms of a urethral stricture?	1	Yes
11- How is a urethral stricture diagnosed?	1	Yes
12- How do I know if my symptoms are related to a urethral stricture or another condition?	1	No
13- Can urethral strictures impact fertility in both men and women?	1	Yes
14- Can urethral strictures lead to erectile dysfunction?	1	Yes
15- Can urethral strictures affect ejaculation or orgasm in men?	1	Yes
16- Do urethral strictures affect female sexual health or libido?	1	Yes
17- What are the treatment options for urethral strictures?	1	Yes
18- Is surgery the only way to treat a urethral stricture?	1	Yes
19- Is surgery the primary treatment for urethral strictures?	1	Yes
20- What are the different surgical techniques used to treat urethral strictures?	1	Yes
21- How long does it take to recover from urethral stricture surgery?	1	Yes
22- Can urethral dilatation effectively treat a stricture?	1	Yes
23- How successful are the treatments for urethral strictures?	1	No
24- Are there any non-surgical alternatives for treating urethral strictures?	1	Yes
25- What are the key differences between invasive and minimally invasive treatments for urethral strictures?	1	Yes
26- Can urethral strictures be managed with medication?	1	Yes
27- Can urethral strictures recur after treatment?	1	Yes
28- What is the likelihood of a urethral stricture recurring after treatment?	1	No
29- Are there any dietary recommendations for individuals with urethral strictures?	1	Yes
30- What causes urethral strictures?	1	Yes
31- Are there any lifestyle changes that can help prevent urethral strictures?	1	Yes
32- Are there any risk factors for developing urethral strictures?	1	Yes
33- Can sexually transmitted infections cause urethral strictures?	1	Yes
34- Can certain medical procedures or surgeries cause urethral strictures?	1	Yes
35- What complications can arise from untreated urethral strictures?	1	Yes
36- Can urethral strictures lead to complications with sexual function or fertility?	1	Yes
37- Are there any long-term effects of living with a urethral stricture?	1	Yes
38- Can urethral strictures increase the risk of urinary tract infections?	1	Yes

General information (between 1st-9th questions), symptoms and diagnosis (between 10th-16th questions), treatment (between 17th-29th questions), prevention (between 30th-34th questions), complications (between 35th-38th questions).

today. These models have not yet reached the perfect level but are rapidly developing. However, the LLMs can facilitate access to medical information and help patients by offering treatment options.⁸ ChatGPT, an artificial intelligence-supported chatbot, is one of the LLMs and is the most assertive in its field. It has a comprehensive knowledge repository covering vari-

ous disciplines, including healthcare.⁹ Yeo et al. investigated the performance of ChatGPT in answering questions about cirrhosis and hepatocellular carcinoma and revealed that the model correctly answered the questions in 76.9% cases.¹⁰ Similarly, ChatGPT can accurately answer questions about urethral strictures and analyze this information to some

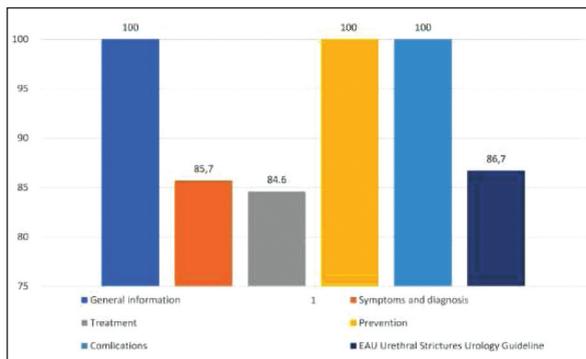


FIGURE 2: Similarity rates of answers to questions.

extent. This study aimed to investigate the reliability of the answers of ChatGPT, which has an exciting potential, to questions about urethral strictures.

In general, medical information circulating on the internet often has no source, and inconsistencies are noted in this information, as it is not provided by experts. This reduces those information's trustworthiness. Lawrentschuk et al. revealed inconsistencies in the quality and reliability of information on websites in their study.⁵ Similarly, Larouche et al. revealed incomplete and frequently biased patient information in their study of midurethral sling videos on YouTube.¹¹ Conversely, ChatGPT works as a system that combines information from multiple reliable sources, unlike information shared on web-supported informative sites or social media. It evaluates data from books, articles, and websites published before 2021. The referenced database is very comprehensive and generates answers by evaluating them, thereby increasing the reliability of ChatGPT. Our study revealed 89.5% accuracy and high reproducibility rate of ChatGPT, which is very important in terms of supporting individuals who seek answers to questions about urethral strictures and increasing access to reliable information.

Social media is indeed effective in terms of information, communication, or advertising in the field of health today; however, the extent to which this information can be understood by the person who will receive the information remains unclear. Rivas et al. emphasized the need to standardize the language used through social media and determined how to objec-

tively measure the impact of published information.¹² The information that ChatGPT provides is easily understood, as ChatGPT functions as chat-based artificial intelligence. Hence, ChatGPT is more accessible and user friendly than other social media data. However, ChatGPT provides timely access to accurate information in difficult geographical and socioeconomic situations. It can prevent the delay of access to medical information or health institutions, especially in areas with impossible access to health institutions or at times such as the COVID-19 pandemic.¹³

ChatGPT is exciting in terms of the benefits it can provide; however, it has several limitations that are considered important. For example, ChatGPT may be insufficient on controversial issues. Routh et al. revealed lower quality content on web pages on controversial urological topics.¹⁴ Our study revealed a lower accuracy of the remaining 50% of answers to the questions about tissue transfer, which is open to improvement and discussion in urethral stricture treatment.

The chatbot is only based on data before 2021 and had no clear sources; therefore, its up-to-dateness may raise concerns, although the information is accurate. Similarly, the answers may be insufficient because the information about urethral strictures in the literature remains untouched and needs improvement, is constantly variable, and lacks up-to-date data. The answers provided by the LLMs, such as ChatGPT, must be constantly updated to remain up-to-date and reliable. Areas, where ChatGPT may be insufficient, should be determined by collaborating with expert healthcare teams during the development of the Chatbot. Therefore, trust in ChatGPT can be increased. The limitations of our study included its single-center design and that only two auditors evaluated the responses. Information on several subjects is conflicting in the literature; therefore, the inability to standardize the scoring system can be considered another study limitation.

CONCLUSION

ChatGPT answered questions regarding urethral strictures with satisfactory accuracy. ChatGPT is pre-

SUPPLEMENTARY TABLE 2: Questions related to guideline recommendations by the European Association of Urology.

European Association of Urology Guideline Questions	Final point	Reproducibility
1- What are the causes of urethral strictures, and what preventive measures should a urologist take?	1	Yes
2- Which catheter material should not be used to avoid urethral stricture?	1	Yes
3- Should urethrotomy be routinely performed when there is no pre-existent urethral stricture?	1	Yes
4- How is the symptom severity and impact on quality of life assessed in men undergoing surgery for urethral stricture disease?	1	Yes
5- What should be performed to patients with suspected urethral stricture disease undergo specific diagnostic tests to assess their condition?	1	Yes
6- What should be performed to assess stricture location and length in men with urethral stricture disease being considered for reconstructive surgery?	1	Yes
7- What should be combined with retrograde urethrography to assess (nearly)-obliterative strictures, stenoses and pelvic fracture urethral injuries?	1	Yes
8- Should magnetic resonance imaging urethrography be considered as an ancillary test in posterior urethral stenoses?	1	Yes
9- Should DVIU be used for penile strictures?	1	Yes
10- Should DVIU/dilatation be used as solitary treatment for long (>2 cm) segment strictures?	1	Yes
11- Should repetitive (>2) DVIU/dilatations be performed if urethroplasty is a viable option?	1	Yes
12- Should urethral stents be used for penile strictures?	1	Yes
13- What should be offered to men with penile urethral stricture disease taking into consideration previous interventions and stricture characteristics?	3	No
14- Should anastomotic urethroplasty be offered to patients with penile strictures >1 cm?	1	Yes
15- Should penile skin grafts or flaps be used in Failed Hypospadias Repair patients with LS or scarred skin?	3	Yes
16- Should genital skin be used in augmentation penile urethroplasty in men with LS related strictures?	3	Yes
17- What should be used for short post-traumatic bulbar strictures with (nearly) complete obliteration of the lumen and full thickness spongiofibrosis?	1	Yes
18- What should be performed for bulbar strictures not amendable to EPA?	1	Yes
19- What should be used for ReDo urethroplasty in the case of a long stricture?	1	No
20- Should perineal urethrostomy be offered as a management option to men with complex anterior urethral stricture disease?	1	Yes
21- Should deep incisions be performed at the 6 and 12 o'clock position during DVIU for VUAS or radiation-induced BMS?	1	Yes
22- Should transurethral resection or "hot-knife" DVIU be performed as first line treatment for patients with non-obliterative BNS after surgery for benign prostatic obstruction?	4	No
23- Should endoluminal treatment be performed in case of VUAS, BMS and BNS with complete obliteration?	1	Yes
24- Is subsequent anti-urinary incontinence surgery needed after transperineal ReDo VUA in a next stage, after at least three to 6 months?	1	Yes
25- Should patients be warned about the possibility of de novo urinary incontinence after reconstruction for bladder neck stenosis or BMS with previous benign prostatic obstruction surgery as the etiology?	1	Yes
26- Should patients be warned about the risk of de novo urinary incontinence and new onset erectile dysfunction after urethroplasty for radiation-induced BMS?	1	Yes
27- Should endoscopic treatment be performed for an obliterative stenosis?	1	Yes
28- Should progressive perineal EPA be performed for obliterative stenosis?	1	Yes
29- Should progressive perineal EPA be performed for non-obliterative stenosis after failed endoluminal treatment?	4	Yes
30- Should midline perineal incision be performed to gain access to the posterior urethra?	1	Yes
31- Should total pubectomy be performed during abdomino-perineal reconstruction?	4	Yes
32- What are the recommended investigations for women with refractory lower urinary tract symptoms?	1	Yes
33- What is the initial treatment for FUS?	1	Yes
34- According to European Urology guidelines, what is the recommended course of action for the first recurrence of FUS?	2	Yes
35- According to European Urology guidelines, what is the recommended course of action for the second recurrence of FUS?	2	Yes
36- For female urethral strictures, under what circumstances should hair-bearing perineal or scrotal flaps be used, if at all, while considering other available options?	1	Yes
37- Should an intra-operative prophylactic regimen with antibiotics be administered at the time of urethral surgery?	1	Yes
38- At urethroplasty, when both a graft and a flap are equally indicated, which one should be preferred?	2	Yes
39- Should patients be informed about the potential complications of different types of oral grafting (buccal versus lingual versus lower lip) when an oral graft is proposed?	1	Yes
40- Is it advisable to use genital skin grafts in cases of lichen sclerosis?	1	Yes
41- Should autologous tissue-engineered oral mucosa grafts be used for urethroplasty outside the frame of a clinical trial?	2	Yes
42- Should a form of validated urethrography be performed after urethroplasty to assess for urinary extravasation before catheter removal?	2	Yes
43- Should follow-up be offered to all patients after urethroplasty surgery?	1	Yes
44- What assessment tool should be used to evaluate subjective outcomes and patient satisfaction?	1	Yes
45- How long should a routine follow-up be offered after urethroplasty, at a minimum?	1	Yes

Aetiology and prevention (between 1st-3rd questions), diagnosis (between 4th-8th questions), management (between 9th-37th questions), tissue transfer (between 38th-41st questions), follow up (between 42nd-45th questions); DVIU: Direct vision internal urethrotomy; LS: Lichen sclerosis; EPA: Excision and primary anastomosis; VUAS: Vesico-urethral anastomosis stricture; BMS: Bulbomembranous strictures; BNS: Bladder neck stenosis; FUS: Female urethral stricture.

dicted to have an important position in the health sector in several areas, mainly in medical information acquisition, disease prevention, diagnosis, treatment, and follow-up owing to its increasing use in the field of health, as in other fields. ChatGPT should be transformed into a place where objectivity and accuracy can be measured by taking the help of health professionals for a more active and reliable use in the field of health.

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: Ali Ayrancı; **Design:** Ufuk Çağlar; **Control/Supervision:** Ömer Sarılar, Faruk Özgör; **Data Collection and/or Processing:** Arda Meriç, Oğuzhan Yıldız; **Analysis and/or Interpretation:** Ali Ayrancı, Ufuk Çağlar; **Literature Review:** Oğuzhan Yıldız, Arda Meriç; **Writing the Article:** Ali Ayrancı; **Critical Review:** Faruk Özgör, Ufuk Çağlar; **References and Fundings:** Ömer Sarılar, Ali Ayrancı.

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