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# Mutfak ve Yemekhane Çalışanlarının Hijyen Kurallarına Uyumu ve Ellerinden Alınan Kültürlerin Mikrobiyolojik Açıdan İncelenmesi

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## ÖZ

Bu çalışma, İstanbul Tuzla ilçesinde bulunan bir vakıf üniversitesinin mutfak ve yemekhanelerinde çalışan, doğrudan yemek üretimine katılan personelin el hijyenlerinin değerlendirilmesi amacıyla planlanmış ve yürütülmüştür. Araştırma süresince kurumda çalışmakta olan 15 personelin ellerinden 6 aylık aralıklarla toplamda 3 defa örnek alınmıştır. Toplanan 90 numune mikrobiyolojik açıdan değerlendirilmiş ve numunelerde E. coli ve diğer koliform grubu bakteriler ile S. aureus bakterisinin varlığı araştırılmıştır. Yapılan mikrobiyolojik değerlendirmeler sonucunda numunelerin hiçbirinde E. coli bakterisi tespit edilmemiştir. Koliform bakteriler ve S. aureus için ortalama değerler sırasıyla 3,6 ve 6,8 kob/cm$^2$ olarak bulunmuştur. Koliform bakteriler numunelerin %40'ında izole edilirken, bu oran S. aureus bakterisi için %95,6 olarak bulunmuştur. Numunelerin tamamı E. coli bakterisi açısından uygun bulunurken, %8,9'u koliform grubu bakteriler açısından ve %95,6'sı S. aureus bakterisi açısından uygun bulunmamıştır. Elde edilen bulgular doğrultusunda görevli personelin tuvalet kullanımı ve çiğ besinlere temas sonrasında el yıkama alışkanlığının olduğu fakat ağız, burun, kulak ve saçlı deri gibi organlar ile cansız yüzeylere temas sonrası bu alışkanlığın olmadığı düşünülmüştür. Belirli aralıklarla el yıkama alışkanlığının kazandırılmasının önemi fark edilmiştir. Besin kaynaklı enfeksiyon ve intoksikasyonlardan korunmak için en önemli faktör olan personelin hijyen eğitimlerine tabi tutulması ve bu eğitimlerin sonuçlarının sıklıkla değerlendirilmesi gerekliliği görülmüştür.

**Anahtar Kelimeler:** Besin güvenliği, hijyen, koliform, E. coli, S. aureus

# The Adherence of Kitchen and Cafeteria Personnel to Hygiene Protocols, and the Microbiological Examination of Cultures Obtained from Their Hands

## ABSTRACT

This study was designed and conducted to evaluate the hand hygiene practices of personnel directly involved in food production in the kitchens and cafeterias of a foundation university located in the

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Tuzla district of Istanbul/Turkey. During the research, a total of 15 personnel working in the institution were selected, and samples were collected from their hands at three intervals, spaced six months apart, to evaluate their hand hygiene practices. The 90 samples obtained were analyzed microbiologically to investigate the presence of E. coli and other coliform bacteria, as well as S. aureus. The microbiological evaluations revealed that none of the samples tested positive for E. coli. The mean values for coliform bacteria and S. aureus were found to be 3.6 and 6.8 CFU/cm², respectively. Coliform bacteria were isolated from 40% of the samples, while this rate was found to be 95.6% for S. aureus. All samples were deemed acceptable in terms of E. coli, while 8.9% and 95.6% of the samples were found to be unacceptable in terms of coliform bacteria and S. aureus, respectively. Based on the obtained results, it was inferred that personnel involved in the study had a habit of washing their hands after using the restroom and encountering raw food, but not after touching organs such as the mouth, nose, ears, and scalp, or inanimate surfaces. The importance of establishing hand washing habits at regular intervals was realized. It was also recognized that to protect against foodborne infections and intoxications, the most critical factor is subjecting personnel to hygiene training and frequently evaluating the outcomes of such training.

**Keywords:** Food safety, hygiene, coliform, E. coli, S. aureus

## 1 Giriş

Hijyen; besin üretimi yapılan işletmelerde ortamın, yapılan çalışmaların ve çalışma düzeninin sağlık ve temizlik ilkelerine uygunluğunu denetler [1]. Besinlerin toplanması, saklanması, işlenmesi ve dağıtılması gibi üretimden tüketime kadar geçen tüm aşama ve sürede besinlere çeşitli mikroorganizmalar bulaşarak, besinleri kalitesiz ve sağlıksız hale getirebilir. Besinlerin tüketiciye güvenli bir şekilde sunulabilmesi için hijyen kurallarının uygulanması ve süreç içerisindeki personelin eğitilmesi elzemdir [2].

Besin kaynaklı hastalıklar genel olarak "patojen mikroorganizmalar ya da mikrobiyal toksinler ile kontamine olmuş gıdaların tüketilmesi ile oluşan ve daha çok gastrointestinal semptomlarla seyreden klinik tablolar" şeklinde tanımlanabilir [3-4]. Bu hastalıklar günümüzde sadece gelişmekte olan ülkelerde değil, gelişmiş ülkelerde de önem arz eden halk sağlığı sorunlarıdır. Besin kaynaklı sorunlarda hastaneye başvuru ve bu başvurularda tür düzeyinde sorumlu mikroorganizma tespit oranı çok düşüktür. Kayıt altına alınan hastalıkların gerçek sayının %10'u veya daha azı olduğu düşünülmektedir [5-6]. Amerika Birleşik Devletleri'nde (ABD) her yıl görülen 76 milyon besin kaynaklı hastalıktan ancak 13,8 milyonunun etkeni bilinmektedir. Bunların ise %67'si viral, %30'u bakteri ve %3'ü parazit kökenli olmasına rağmen, hastanede tedavi gerektiren hastalıkların %60'ının bakteriyel sebeplerle meydana geldiği görülmektedir [7].

Besin kaynaklı hastalıklar enfeksiyonlar ve intoksikasyonlar olarak sınıflandırılabilir. Besin maddesinin patojen bir mikroorganizma ile kontamine olması ve bu mikroorganizmanın çoğalarak, toksin salgılaması sonrası, bu besin maddesinin tüketilmesiyle meydana gelen zehirlenmeye besin kaynaklı intoksikasyon adı verilmektedir [8].

Staphylococcus aureus intoksikasyonu dünyada en sık görülen gıda kaynaklı hastalıklardan biridir [9]. Staphylococcus aureus: Staphylococcaceae familyasındaki en patojen tür olan, Gram pozitif, kok şeklinde, hareketsiz, sporsuz, bazı suşları kapsüllü, fakültatif anaerofilik özellikte, uygun ortam koşullarında 7-48°C arasında üreyebilen mezofilik bir bakteridir [10]. S. aureus, özellikle ısıl işlem olmak üzere mikroorganizmaların eliminasyonuna yönelik işlemlere karşı yüksek hassasiyet göstermesiyle beraber, insanlarda, besin intoksikasyonlarına sebep olan ve yüksek sıcaklığa dayanıklılık gösteren enterotoksinler oluşturmaktadır. Stafilokokal hastalıklar genellikle üretim sonrası personel ya da araç gereçlerden S. aureus ile kontamine olmuş besinlerden kaynaklanmaktadır. Zehirlenmelere sebep olan besinlerin ortak özellikleri; genellikle pişirilmiş, el ile hazırlanan ve tüketime kadar

buzdolabında saklanan besinler olmalarıdır [11]. S. aureus'un kontrol edilmesinde en önemli etken personeldir. Çalışanlar besinlerin hazırlanması, pişirilmesi ve sunumu esnasında hijyen kurallarına özen göstermelidir. Bir önemli nokta da ısıl işlem sonrası besinlerin hızlı bir şekilde soğutulması ve buzdolabı sıcaklığında saklanmasıdır. Ayrıca işletmede çapraz bulaşma noktaları sıklıkla kontrol edilmelidir [12].

Besin kaynaklı enfeksiyonlarda ise hastalık etmeni olan patojen bakteriler besinler üzerinde çoğalmış olarak vücuda alınırlar. Bunlar gastrointestinal sistemde tutunarak yayılır ve enflamasyona sebep olurlar. Bu enfeksiyonlara yol açan koliform bakteriler: "Gram negatif, fakültatif anaerob, spor oluşturmayan, 35-37°C'de laktozdan gaz oluşturan çubuk şekilli bakteriler" olarak tanımlanmaktadır. Citrobacter, Enterobacter, Escherichia, Hafnia, Klebsiella, Serratia bakterileri bu gruba örnek olarak verilebilir [8]. Fekal koliform bakteriler ise insan ve sıcak kanlı hayvanların bağırsak florasında bulunan spesifik bir bakteri grubudur. Bu gruptaki E. coli de bağırsak kökenli olması sebebiyle, E. coli barındıran bir kültür direkt ya da dolaylı bir şekilde (kanalizasyon vasıtasıyla) dışkı ile kontamine olmuş varsayılır [13]. Fekal koliform bakterilerden gıda güvenliğinde "indikatör mikroorganizma" olarak yararlanılmaktadır. İndikatör mikroorganizmalar gıda sanayisinde kurallara uygun olarak üretim yapılıp yapılmadığının ve kalitenin göstergesi olarak değerlendirilir [14].

Deri, burun ve boğaz Staphylococcus türlerinin, bağırsak ise Escherichia coli'nin başlıca kaynağıdır. E. coli'nin herhangi bir ortamda bulunması, doğrudan veya dolaylı olarak insan ya da hayvan dışkısı ile kirlenmeyi gösterir. Bu da dışkıda bulunabilecek diğer patojenlerin de bulunabileceği riskine işaret eder. Bu sebeplere personele tuvalet hijyeninin öneminin aktarılması, el yıkama alışkanlıkları kazandırılması ve hijyen bilincinin geliştirilmesi gerekmektedir [15]. Özellikle pişmiş ve çiğ gıdaların arasında meydana gelebilecek çapraz kontaminasyonlar sonucu E. coli, Salmonella spp., Shigella spp. gibi fekal bakteriler ile S. aureus gibi mikroorganizmalar personel aracılığıyla gıdalara bulaşabilmektedir. Fekal yolla bulaşan bakteriler tuvalet sonrası yetersiz el hijyeninin kanıtı iken, S. aureus, Micrococcus, Lactobacillus, Moraxella gibi bakteriler personelin üretim esnasında ellerini üretim alanı dışındaki yüzeylere temas ettirdiklerini gösterir [16].

Bu araştırmada yemek üretim ve servisinde çalışan kişilerin ellerinden alınan kültürlerde, besin güvenliği için önemli olan, personel kaynaklı, E. coli ve diğer fekal koliform bakteriler ve S. aureus bakterileri varlığının tespiti ve sonuçların genel hijyen kurallarına göre değerlendirilmesi amaçlanmıştır.

## 2 Metodoloji

Tanımlayıcı tipte tasarlanan çalışmada İstanbul'da bulunan bir vakıf üniversitesinin mutfak ve yemekhanesi bünyesinde yemek üretiminde çalışan tüm personel (n=15) çalışmaya dahil edilmiştir. Evrenin tamamı örneklem olarak seçilerek, 09.05.2018 tarihinde alınan etik kurul onayı akabindeki bir yıl içerisinde farklı zamanlarda toplamda 90 numune alınmıştır.

### 2.1 Veri Toplama Araçları

Numune toplanmasında bir yüzünde Staphylococcus aureus (S. aureus) varlığını tespit etmede kullanılan CHROMagarTM S. aureus, diğer yüzünde Escherichia coli (E. coli) ve koliform bakteri tespitinde kullanılan CHROMagarTM ECC bulunan 06005 katalog numaralı HygiSlide CHR. ECC/ CHR. S. aureus ürünü kullanılmıştır. HygiSlide: personel hijyen kontrollerini kolay ve doğru bir şekilde yapılmasını sağlayan bir üründür [17].

Çalışmada; Emniyet kabini (Nüve Mn120 class II), Etüv / İnkübatör (Nüve EN400), Mikroskoplar (Eclipse E200 Binoküler ve Olympus CX41) ve Fotoğraf makinesi (Olympus DP73) kullanılan

aletlerden olup, lam, lamel, öze, immersiyon yağı ve çeşitli boyalar gibi sarf malzemeleri de kullanılmıştır.

## 2.2 Veri Toplama Yöntemi

Üniversitesinin yemek üretim bölümüne haber vermeksizin, altı aylık aralıklar üç kez; et hazırlama, sebze hazırlama, tatlı hazırlama bölümleri de dahil olmak üzere yemek üretimi yapılan alanda üretime katılan personelin tümünün ellerinden örnekler alınmıştır. Toplamda alınan 90 numune İstanbul Okan Üniversitesi Tıp Fakültesi Mikrobiyoloji Laboratuvarında incelenmiştir. Kullanılan besiyerleri spesifik bakterilere seçici olduğu için bakteri sınıflandırmasında herhangi başka bir yöntem kullanılmamıştır. Numuneler personellerin ellerinden ayrıca herhangi bir materyale (swap vb.) ihtiyaç duyulmadan doğrudan besiyerine temas ile alınmıştır. Örneklerin personelin yoğun olarak çalıştığı, yemek hazırlama ve pişirme saatlerinde alınmasına dikkat edilmiştir.

Alınan numuneler 36,5°C'de 36-48 saat arası inkübe edilmiştir. İnkübasyon sonucu CHROMagarTM S. aureus besiyerinde S. aureus bakterisi pembe ve lila renklerinde; CHROMagarTM ECC besiyerinde E. coli bakterisi mavi, diğer koliform bakteriler lila renkte ve diğer gram negatif bakteriler ise renksiz koloniler oluşturacak şekilde görülmektedir.

El hijyeni uygulamalarında incelenen bakteriler bazında bulunmasına izin verilen maksimum değerler literatürde koliform için <10 kob/cm², E. coli için: 0 kob/cm² ve S. aureus için: 0 kob/cm² olarak bulunmuştur [18]–[20]. Çalışmada elde edilen veriler literatürdeki uygunluk değerleriyle karşılaştırılarak, personelin ellerinden alınan örneklerin hijyen açısından değerlendirilmesi, incelenen bakterilerin yüzde olarak uygun olup olmaması yönünden de hesaplanarak değerlendirilmiştir.

Gelişen kolonilerden mikrobiyolojik emniyet kabini içerisinde öze yardımıyla alınan örnekler, üzerinde 1 damla distile su bulunan lam üzerinde ezilip, ince bir film haline getirilmiştir. Hazırlanan bu preparatlara fiksasyon işlemi yapılmış, ardından preparatlar gram boyama işlemine tabi tutulmuştur.

Gram boyaması yapılmış preparatlar Olympus CX41 mikroskobu ile 100x mercek altında incelenmiş ve mikroskoba takılı bulunan Olympus DP73 fotoğraf makinesi ile fotoğrafları çekilmiştir. Çekilen fotoğraflar Olympus CellSens Entry programı ile incelenmiştir.

## 2.3 İstatistiksel Yöntemler

Çalışmada elde edilen bulgular SPSS 22.0 programı aracılığıyla değerlendirilmiştir. Değerlendirmede tanımlayıcı istatistiklerin analizinde frekans, yüzde, ortalama, standart sapma, ortalama fark, minimum, maksimum değerlerinden faydalanılmıştır.

Sayılamayacak kadar çok bakteri tespit edilen numunelerde bakteri sayısı araştırmacı tarafından Hygislide kullanma kılavuzu dikkate alınarak, 100 kob ve üzeri olarak belirlenmiştir. Kullanılan HygiSlide ürünü 2 cm² olduğu için istatistiki değerlendirmede bu sayı 50 kob/cm² olarak hesaplanmıştır.

Elde edilen bakteri sayılarının tekrarlara göre fark analizi incelenirken tekrarlı ölçümlerde varyans analizi (ANOVA) uygulanmıştır. Uygulama öncesinde verilerin homojen dağılıp dağılmadığı bakteri grupları için ayrı ayrı Kolmogorov Smirnov testi ile incelenmiştir. Tekrarlı ölçümlerde normal dağılım göstermeyenlerde non parametrik test olan Friedman Testi, normal dağılım gösterenlerde parametrik test olan tekrarlı ölçümlerde varyans analizi (ANOVA) uygulanmıştır.

Çalışmada tekrarlı ölçümler varyans analizinin varsayımlarından olan küresellik durumu Mauchly's testi ile test edilmiş, ardından küreselliğin sağlanmaması nedeniyle Greenhouse Geisser testi sonuçları değerlendirmeye alınarak, elde edilen ANOVA test istatistiği (F) ve sigma (p) değeriyle analiz sonucuna gidilmiştir. Analiz sonucunda tekrarlar arasındaki anlamlılık durumu, bir post-hoc analizi olan ve tekrarlı ölçümler varyans analizinde kullanılan Bonferrroni testi ile incelenmiştir. Sonuçlar %95'lik güven aralığında, $p<0,05$ anlamlılık düzeyinde değerlendirilmiştir

# 3 Bulgular ve Tartışma

## 3.1 Bulgular

Numunelerde E. coli ve diğer fekal koliform bakteriler ile S. aureus bakterisinin varlıkları araştırılmış, varlığı tespit edilen numunelerin sayımları cm² başına koloni oluşturabilen bakteri (kob) cinsinden olmak üzere Tablo 1'de verilmiştir.

**Tablo 1:** *Bakterilerin personel ve ölçümler bazında dağılımı (kob/cm²)*

| Personel No | Tekrar 1 | | | Tekrar 2 | | | Tekrar 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| | E. coli | Koliform | S. aureus | E. coli | Koliform | S. aureus | E. coli | Koliform | S. aureus |
| 1 | 0 | 0 | 5 | 0 | 0 | 3 | 0 | 0 | 5 |
| 2 | 0 | 1 | 2 | 0 | 0 | >50 | 0 | 0 | 2 |
| 3 | 0 | 0 | 6 | 0 | 0 | 2 | 0 | 0 | 8 |
| 4 | 0 | 2 | 8 | 0 | 0 | 3 | 0 | 8 | 0 |
| 5 | 0 | 2 | >50 | 0 | 1 | 5 | 0 | 1 | 4 |
| 6 | 0 | 5 | 3 | 0 | 0 | 5 | 0 | >50 | 2 |
| 7 | 0 | 1 | 2 | 0 | 4 | 1 | 0 | 0 | 2 |
| 8 | 0 | 0 | 4 | 0 | 13 | 1 | 0 | 0 | 0 |
| 9 | 0 | 2 | >50 | 0 | 1 | 3 | 0 | 0 | 8 |
| 10 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 2 |
| 11 | 0 | 0 | 2 | 0 | 0 | 4 | 0 | 12 | 5 |
| 12 | 0 | >50 | 2 | 0 | 0 | 4 | 0 | 0 | 5 |
| 13 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 4 | 6 |
| 14 | 0 | 0 | 5 | 0 | 0 | 4 | 0 | 0 | 8 |
| 15 | 0 | 0 | 10 | 0 | 0 | 8 | 0 | 1 | 1 |

Koloni sayımları sonucu hiçbir numunede E. coli görülmezken, koliform grubu bakterilerin ve S. aureus bakterisinin bazı numunelerde sayılamayacak kadar çok (>50 kob/cm²) olduğu tespit edilmiştir. Numunelerin %40'ında koliform grubu bakterilerin varlığı tespit edilirken, bu oran S. aureus bakterisi için %95,6 bulunmuştur. Koliform bakteriler için genel dağılımın 0-5 kob/cm² aralığında olduğu görülmektedir. İkisi 50 kob/cm² değerinin üzerinde olmakla beraber toplamda dört numunenin 10 kob/cm² sınırının üzerinde olduğu tespit edilmiştir. S. aureus bakterisi için genel dağılımın 0-10 kob/cm² aralığında olduğu görülmektedir. Üç numunede 50 kob/cm² değerinin üzerinde olup, yalnızca iki numunede S. aureus bakterisi izole edilmemiştir.

Koliform grubu ve S. aureus için 1. ve 2. tekrarlarda, 3. tekrarda ise yalnız koliform grubu için sayılamayacak kadar çok bakteri tespit edildiği görülmektedir. S. aureus bakterisi için ortalama değerler kabul edilebilir sınırların üzerinde bulunmuştur. Standart sapmanın yüksekliği bazı çalışanların el hijyenine dikkat ederken bazılarının daha özensiz olduğunu göstermektedir. Tekrarlı ölçümler bazında tespit edilen bakterilerin minimum ve maksimum değerleri, ortalamaları ve standart sapmaları Tablo 2'de verilmiştir.

**Tablo 2:** *Bakterilerin tekrarlı ölçümler bazında tanımlayıcı istatistikleri (kob/cm²)*

| | n | Alt | Üst | X̄ | SS |
|---|---|---|---|---|---|
| **Tekrar 1** | | | | | |
| E. coli | 15 | 0 | 0 | 0,00 | 0,00 |
| Koliform | 15 | 0 | 50 | 4,20 | 12,75 |
| S. aureus | 15 | 1 | 50 | 10,13 | 16,38 |
| **Tekrar 2** | | | | | |
| E. coli | 15 | 0 | 13 | 0,00 | 0,00 |
| Koliform | 15 | 0 | 50 | 1,33 | 3,40 |
| S. aureus | 15 | 1 | 50 | 6,40 | 12,20 |
| **Tekrar 3** | | | | | |
| E. coli | 15 | 0 | 0 | 0,00 | 0,00 |
| Koliform | 15 | 0 | 50 | 4,53 | 12,95 |
| S. aureus | 15 | 0 | 8 | 4,40 | 2,80 |

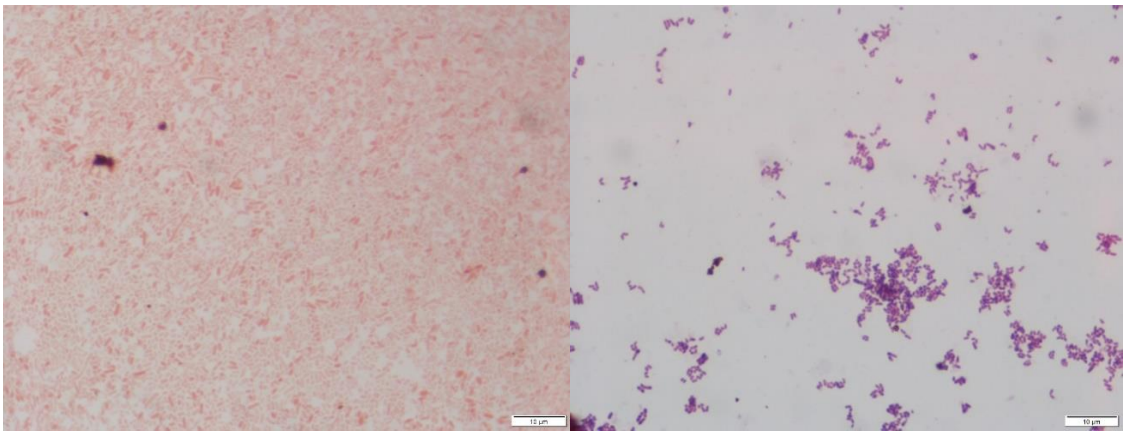
X̄: Ortalama; SS: Standart sapma.

Numunelerin hiçbirinde E. coli bakterisi tespit edilmemiş olup, tamamı uygun bulunmuştur. Bu sebeple diğer istatistiki testler E. coli bakterisi için uygulanmamıştır. Numunelerin diğer koliform grubu ve S. aureus bakterileri bazında uygunluk durumları Tablo 3'te verilmiştir.

**Tablo 3:** *Numunelerdeki bakterilere göre uygunluk durumu*

| | Tekrar 1 | | Tekrar 2 | | Tekrar 3 | | Toplam | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | n | % |
| **Koliform** | | | | | | | | |
| Uygun (n<10) | 14 | 93,3 | 14 | 93,3 | 13 | 86,7 | 41 | 91,1 |
| Uygun Değil (n≥10) | 1 | 6,7 | 1 | 6,7 | 2 | 13,3 | 4 | 8,9 |
| **S. aureus** | | | | | | | | |
| Uygun (n=0) | 0 | 0 | 0 | 0 | 2 | 13,4 | 2 | 4,4 |
| Uygun Değil (n>0) | 15 | 100 | 15 | 100 | 13 | 86,6 | 43 | 95,6 |

Koliform grubu ve S. aureus tespit edilen numunelerden izole edilen bakteriler, Olympus CX41 marka mikroskopla x100 mercek altında incelenip Olympus DP73 marka fotoğraf makinesiyle fotoğraflanmıştır. Çekilen fotoğraflar (Şekil 1), Olympus CellSens Entry programıyla incelenmiş ve literatürdeki verilerle karşılaştırılmıştır.



**Şekil 1:** *Koliform grubu (solda) ve S. aureus (sağda) bakterilerinin mikroskop altındaki görüntüsü*

Koliform grubu bakterilerin tekrarlara göre fark analizi incelendiğinde (Tablo 4); yapılan tekrarlı ölçümlerde varyans analizine göre, tekrarlar arasında anlamlı bir fark olmadığı tespit edilmiştir ($F^1$= 0,391; $p^1$=0,648).

**Tablo 4:** *Koliform grubu bakterilerin tekrarlara göre fark analizi*

| | N | X̄ | SS | Alt | Üst | Test ve Anlamlılık |
|---|---|---|---|---|---|---|
| Tekrar 1[1] | 15 | 4,200 | 12,745 | 0,000 | 50,000 | $F^1$= 0,391 |
| Tekrar 2[1] | 15 | 1,333 | 3,394 | 0,000 | 50,000 | $p^1$= 0,648 |
| Tekrar 3[1] | 15 | 4,533 | 12,966 | 0,000 | 50,000 | |
| | | **Ortalama Fark** | | | | |
| Tekrar 1-2p[2] | | 2,867 | | | | $p^2$= 1,000 |
| Tekrar 1-3p[2] | | -0,333 | | | | $p^2$= 1,000 |
| Tekrar 2-3p[2] | | -3,200 | | | | $p^2$= 1,000 |

*[1]: Tekrarlayan ölçümlerde varyans analizi (Greenhouse-Geisser) [2]: Bonferroni test;* p < 0,05;
X̄: Ortalama; SS: Standart sapma.

S. aureus bakterisinin, tekrarlara göre fark analizi incelendiğinde (Tablo 5); yapılan tekrarlı ölçümlerde varyans analizine göre, tekrarlar arasında anlamlı bir fark olmadığı tespit edilmiştir ($F^1$= 0,861; $p^1$=0,408).

**Tablo 5:** *S. aureus bakterisinin tekrarlara göre fark analizi*

| | N | X̄ | SS | Alt | Üst | Test ve Anlamlılık |
|---|---|---|---|---|---|---|
| Tekrar 1[1] | 15 | 10,133 | 16,378 | 1,000 | 50,000 | $F^1$= 0,861 |
| Tekrar 2[1] | 15 | 6,400 | 12,199 | 1,000 | 50,000 | $p^1$= 0,408 |
| Tekrar 3[1] | 15 | 4,400 | 2,797 | 0,000 | 8,000 | |
| | | **Ortalama Fark** | | | | |
| Tekrar 1-2p[2] | | 3,773 | | | | $p^2$= 1,000 |
| Tekrar 1-3p[2] | | 5,773 | | | | $p^2$= 0,553 |
| Tekrar 2-3p[2] | | 2,000 | | | | $p^2$= 1,000 |

*[1]: Tekrarlayan ölçümlerde varyans analizi (Greenhouse-Geisser) [2]: Bonferroni test;* p < 0,05;
X̄: Ortalama; SS: Standart sapma.

### 3.2 Tartışma

Gıda işletmelerinde hijyenin sağlanmasının temel amacı tüketiciye sağlıklı, güvenilir ve kaliteli gıda sunmaktır. Bu nedenle hammaddeden son ürüne kadar tüm aşamalarda hijyen kontrollerin sağlanması büyük önem taşımaktadır [21]. Çalışma sonunda el numuneleri bakteriler bazında karşılaştırıldığında; E. coli %100, koliform %91,1 ve S. aureus %2,2 oranında uygun olarak değerlendirilmiştir. Civan'ın [22] yaptığı benzer çalışmada İstanbul ve çevresinde et üretimi yapılan işletmelerde çalışan 170 personelden aldıkları numunelerde koliform grubu bakteriler ile E. coli varlığı incelenmiş, numunelerin %32'si uygun olarak değerlendirilmiştir. Civan, çalışmasında yaz aylarında alınan numunelerin, kışa göre mikrobiyolojik uygunluğunun daha düşük olduğunu belirtmiştir. Bu çalışmada ise mevsimler arası böyle bir fark görülmemiştir. Sıcak havalarda bakterilerin üremesi daha kolay olmasına rağmen bir fark görülmemesi sebebiyle Civan'ın örneklemine kıyasla bu çalışmaya katılanların daha sık ellerini yıkadıkları veya daha kısa süre mesai yaptıkları düşünülebilir.

Lues ve Van Tonder'in [23] yaptıkları çalışmada besin üretiminde görevli 50 personelin ellerinden aldıkları toplam 300 numunede %40 oranında koliform bakteri tespit edilmiş olup, bulunan koliform sayısı kabul edilebilirlik açısından %68 oranında uygun bulunmuştur. Bu araştırmada da alınan örneklerde %40 oranında koliform bakteri tespit edilmiştir, fakat uygunluk oranı %91,1 olarak bulunmuştur. Bu durum, Lues ve Van Tonder'in çalışmasında izole edilen koliform bakterilerin kob/cm² bakımından daha yoğun olduğunu göstermektedir. Aynı çalışmada E. coli bir çalışanın elinden izole edilirken bu çalışmada hiçbir personelin elinden alınan numunede E. coli'ye rastlanmamıştır. Yine aynı

çalışmada S. aureus numunelerin %88'inde tespit edilirken, bu çalışmada %95,6'sında tespit edilmiştir. Her iki çalışmada da en fazla izole edilen bakterinin S. aureus olması el yıkama sıklıklarının düşük olduğunun bir göstergesidir.

Lambrechts ve arkadaşlarının [24] yaptığı bir çalışmada 40 gıda üretim noktasına çalışmakta olan 230 personelin ellerinden, ellerini yıkadıktan sonra örnekler alınmış olup, bu örneklerde E. coli ve S. aureus bulunup bulunmadığına bakılmıştır. Numunelerin hiçbirinde S. aureus bakterisine rastlanmazken, bir numunede E. coli izole edilmiştir. Bu çalışmada ise personel el örnekleri haber verilmeden alınmış olup, özellikle S. aureus varlığı çok yüksek oranda (%95,6) tespit edilmiştir. Aradaki bu fark özellikle S. aureus kaynaklı intoksikasyonlardan korunmada el yıkamanın önemini göstermektedir.

Tabak'ın [25] yaptığı çalışmada besin üretimi yapılan 100 işletmenin her birinden 4 personel seçilmiş ve 2 tekrarlı olmak üzere personel ellerinden toplam 800 numune toplanmıştır. Alınan bu numunelerin %9,6'sında E. coli varlığı tespit edilmiştir. Temelli ve arkadaşlarının [26], et parçalama ve peynir üretimi yapan personelin hijyenik durumlarını değerlendirmek üzere yaptığı çalışmada, kasap çalışanlarının ellerinden alınan 16 numunenin 6'sında (%37,5), mandıra çalışanlarının ellerinden alınan 14 numunenin ise 4'ünde (%28,5) E. coli tespit etmişlerdir. Fidan ve Ağaoğlu'nun [27] çalışmasında, Ağrı ilinden seçilen 20 lokantada çalışan, birer aşçı ve birer garsonun ellerinden aldıkları numuneler incelenmiş, aşçı ve garsonların ellerinden alınan numunelerde sırasıyla %75 ve %70 oranlarında E. coli tespit edilmiştir. Akarca ve arkadaşları [28] tarafından Afyon'da bulunan süt işletmelerinde yapılan çalışmada 5 ayrı fabrikadan, 30'ar personelin ellerinden numuneler alınmıştır. Toplamda alınan 150 kültürden 1'inde (%0,07) E. coli tespit edilmiştir. Bu çalışmada ise hiçbir numunede E. coli tespit edilmemiştir. Ghazali ve arkadaşları [29], E. coli bakterisinin personel elinde olmaması gerektiği ve varlığının fekal kontaminasyon göstergesi olarak değerlendirilmesi gerektiğini vurgulamıştır. Elde edilen sonuçlar incelendiğinde doğrudan ve yoğun şekilde hayvansal ürünlere temas halinde çalışanlar ile küçük işletmelerde çalışanlarda yüksek oranlarda E. coli izole edildiği görülürken; büyük işletme ve fabrika vb. yerlerde çalışanlarda bu oran düşmektedir. Bu durum büyük işletmelerde hijyen kurallarına bağlılığın daha yüksek olduğunu işaret etmektedir.

Çalışmada koliform bakteri varlığı incelendiğinde numunelerin %40'ında tespit edildiği gözlemlenmektedir. Tabak'ın [25] yaptığı çalışmada bu oran %17,8 iken, Fidan ve Ağaoğlu [27] çalışmalarında %100 olarak tespit etmişlerdir. Campos ve arkadaşlarının [30] Brezilya'daki 27 okul kantinindeki birer çalışanın elinden üç tekrar şeklinde aldıkları örneklerde koliform bakteriler ile kontaminasyon oranı %55,6 olarak bulunmuştur. Konecka-Matyjec ve arkadaşlarının [31] çalışmasında ise Polonya'daki hastanelerin mutfaklarında çalışan personel ellerinden üç tekrarlı olacak şekilde aldıkları 348 numune %97,2 oranında uygun olarak değerlendirilmiştir. Bu çalışmada ise uygunluk oranı %91,1 olarak belirlenmiştir. Önemli bir hijyen indikatörü olan koliform bakterilerin tamamı zararlı olmasa dahi, çevresel veya fekal bir bulaş olduğunun göstergesidir.

Çalışmada incelenen S. aureus bakterisi ise numunelerin %95,6'sında tespit edilmiştir. Fidan ve Ağaoğlu [27] çalışmalarında mutfak ve servis personeli elinde S. aureus bakterisine rastlanma oranı sırasıyla aşçı ve garsonlarda %90 ve %85 düzeylerinde bulunurken, Aydın ve arkadaşları [32] tarafından yapılan çalışmada ise besin üretiminde çalışan personelin elinden alınan 266 numunenin %38,7'sinde tespit edilmiştir. Tabak'ın [25] çalışmasında bakteriye %22,5 oranında rastlanılmış ve personel hijyeni açısından olumsuz olarak değerlendirilmiştir. Bu oran Fidan ve Ağaoğlu'un [27] çalışması ve bu çalışmadaki oranların çok altındadır. Besin kaynaklı intoksikasyonların başlıca sorumlusu olarak görülen S. aureus bakterisinin yapılan çalışmalarda yüksek oranlarda bulunması personelin hijyen alışkanlıklarının yetersiz olduğunu göstermekte ve sağlık açısından risk oluşturmaktadır.

# 4 Sonuçlar

Araştırma sonuçlarına bakıldığı zaman E. coli bakterisi hiç izole edilemezken diğer koliformlar belirli miktarlarda bulunmuş ve S. aureus bakterisinin çok yüksek oranlarda tespit edilmiştir. Bu durum, yemek üretiminde çalışmakta olan personelin, tuvalet kullanımı ve çiğ besinle (çiğ et vb.) teması sonrası ellerini yıkadığı fakat bunun dışında ağız, burun, kulak, saç gibi bölgelere veya cansız yüzeylere teması sonrasında aynı alışkanlığının olmadığını göstermektedir.

Koliform bakteri tespiti çevresel veya fekal kontaminasyonun göstergesi olduğu için besin üretiminde görev alan personelin bu konuda bilinçlendirilmesi ve el hijyenine özen gösterilmesi gerekmektedir. Fekal koliformlardan korunmak için tuvalet kullanımı ve çiğ besinlere temas sonrası, çevresel koliformlardan korunmak içinse yüzeylere, özellikle tozlu, topraklı yüzeylere temas sonrası mutlaka ellerin yıkanması gerekliliği görevli personele aktarılmalıdır.

S. aureus bakterisi enfektif değil toksikatif bir bakteri olup, besin zehirlenmesine yol açmak için belirli bir sayıya ulaşması ve toksin salgılayabilecek sıcaklıkta beklemesi gerekmektedir. İntoksikasyonun klinik belirtilerinin görülmesi için besinler ile yaklaşık 1 mg ve üzeri toksinin vücuda girmesi gerekmektedir. S. aureus, özellikle ısıya dayanıksız bir bakteri olduğu için personel elinde yüksek oranlarda görülmesine karşın besin zehirlenmesi vakaları aynı oranda görülmemektedir. Buna rağmen personelin elinden bu kadar yüksek oranlarda S. aureus izole edilmesi ciddi bir hijyen eksikliğine işaret etmektedir. S. aureus sağlıklı insanların ağız, burun, boğaz boşluklarında bulunduğu gibi saçlı derilerde de görülmektedir. Bu sebeple S. aureus intoksikasyonlarının birincil sorumlusu olarak personel görülmektedir. S. aureus intoksikasyonlarını önlemek için personele vücut yüzeylerine dokunduktan sonra ve ihtiyaç hissedilmese dahi belirli aralıklarla el yıkamanın önemi anlatılmalıdır.

Araştırma sonuçlandırıldıktan sonra ilgili personele diyetisyen ve gıda mühendisi tarafından konunun önemini hatırlatan eğitim verilmiş ve yönetim, bulgular hakkında bilgilendirilmiştir.

# 5 Beyanname

Bu çalışma yazarın yüksek lisans tezinden üretilmiştir.

## 5.1 Çalışmanın Sınırlılıkları

Araştırma bir üniversitenin mutfak ve yemekhane çalışanları ile yapılmıştır, topluma genellenemez.

## 5.2 Teşekkür

Araştırmaya katılmaya gönüllü olan çalışanlara ve istatistiksel analizlerde yol gösteren Dr. Salim Yılmaz'a teşekkür ederiz.

## 5.3 Finansman Kaynağı

Bu araştırma için herhangi bir finansal destek alınmamıştır.

## 5.4 Çıkar Çatışması

Bu çalışmada herhangi bir çıkar çatışması yoktur.

### 5.5 Yazarların Katkıları

**Sorumlu Yazar Ahmet Murat GÜNAL:** Makale yüksek lisans tezinden üretilmiştir. Katkıları şu şekilde: Araştırma için fikir ve hipotezin oluşturulması, Sonuçlara ulaşmak için gereç ve yöntemlerin planlanması, deneylerin yapılması, verilerin düzenlenmesi ve bildirilmesi için sorumluluk almak, bulguların mantıklı açıklanması ve sunumu için sorumluluk almak, araştırma sırasında literatür taraması ile ilgili sorumluluk almak, yazının tümü veya asıl bölümün oluşturulması için sorumluluk almak, makaleyi teslim etmeden önce sadece imla ve dil bilgisi açısından değil aynı zamanda entelektüel içerik açısından yeniden çalışma yapmak.
**2. Yazar Aylin SEYLAM KÜŞÜMLER:** Sorumlu yazarın yüksek lisans tez danışmanı. Katkıları şu şekilde: Verilerin bildirilmesi için sorumluluk almak, bulguların mantıklı açıklanması ve sunumu için sorumluluk almak, araştırma sırasında literatür taraması ile ilgili sorumluluk almak, yazının tümü veya asıl bölümün oluşturulması için sorumluluk almak, makaleyi teslim etmeden önce sadece imla ve dil bilgisi açısından değil aynı zamanda entelektüel içerik açısından yeniden çalışma yapmak.

## 6 İnsan ve Hayvanlarla İlgili Çalışma

### 6.1 Etik Onay

Bu araştırmanın yürütülmesi için İstanbul Okan Üniversitesi Etik Kurulundan 09.05.2018 tarihinde yapılan 94 numaralı toplantı sonucu 28 karar sayısı ile onay alınmıştır.

### 6.2 Bilgilendirilmiş Onam

Çalışma için tüm katılımcılardan çalışmaya katılmayı kabul ettiklerine dair bilgilendirilmiş onam formu alınmıştır.

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# Satisfaction Status of Pharmacists Towards Pharmacy Information Systems: A Qualitative Study

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## ABSTRACT

The aim of the study is to qualitatively assess the satisfaction of fifteen pharmacists in Türkiye regarding the use of Pharmacy Information Systems and gain insights into their opinions about these systems. The present study was conducted in Zeytinburnu, Istanbul. Pharmacists or pharmacy owners voluntarily participated, answering pre-set questions about their satisfaction and challenges with PIS. Our main findings revealed that Pharmacists' satisfaction is related to the system's speed, ease of use, practicality, and functionality. However, a significant portion of participants were unable to pinpoint any satisfactory aspects, suggesting that there is a need for improvements in user experience. Most notably, issues concerning the Social Security Institution (SSI) system stood out as a major concern, with many participants expressing dissatisfaction. System update processes and slow system speed were other significant issues. Our study revealed that there is a need to organize training and support programs to improve user experience and system speed, solve problems related to Social Security Institution integration, make electronic information systems more functional, make stock control and drug tracking systems more effective, prevent misleading information and enable pharmacists to use the system more efficiently.

**Keywords:** pharmacies, digitalization, pharmacy information systems, electronic information systems, pharmacist satisfaction.

# Eczacıların Eczane Bilgi Sistemleri Hakkındaki Memnuniyet Durumu: Nitel Bir Çalışma

## ÖZ

Çalışmanın amacı, Türkiye'de on beş eczacının Eczane Bilgi Sistemleri kullanımı konusundaki memnuniyetini niteliksel olarak değerlendirerek eczane bilgi sistemlerine yönelik görüşlerine ilişkin fikir sahibi olmaktır. Çalışma İstanbul'un Zeytinburnu ilçesinde gerçekleştirilmiştir. Eczacılar veya eczane sahipleri gönüllü olarak katılmış ve EBS ile ilgili memnuniyet ve zorluklarla ilgili önceden belirlenmiş soruları yanıtlamışlardır. Eczacıların memnuniyeti sistemin hızı, kullanım kolaylığı, pratikliği ve işlevselliği ile ilgilidir.Ancak, katılımcıların önemli bir kısmı memnun oldukları herhangi bir yön belirleyemedi, bu da kullanıcı deneyiminde iyileştirmelere ihtiyaç olduğunu vurguladı. En dikkat çeken husus, Sosyal Güvenlik Kurumu (SGK) sistemi ile ilgili sorunlardı. Katılımcıların büyük bir kısmı bu konuda memnuniyetsizliklerini dile getirdi. Sistem güncelleme süreçleri ve yavaş sistem hızı diğer önemli sorunlar arasında yer almaktadır. Çalışma, kullanıcı

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deneyimini ve sistem hızını artıran iyileştirmelere, Sosyal Güvenlik Kurumu entegrasyonuyla ilgili sorunların çözülmesine, elektronik bilgi sistemlerini daha işlevsel hale getirmeye, stok kontrolü ve ilaç takip sistemlerini daha etkili hale getirmeye, sistemde yanlış veya yanıltıcı bilgilerin önlenmesine ve eczacıların sistemi daha verimli bir şekilde kullanabilmelerini sağlamak için eğitim ve destek programlarının düzenlenmesine ihtiyaç olduğunu ortaya koymuştur.

**Anahtar Kelimeler:** eczaneler, dijitalleşme, eczane bilgi sistemleri, elektronik bilgi sistemleri, eczacı memnuniyeti.

## 1 Introduction

The origins of pharmacy and pharmacies can be traced back to ancient Egypt according to known history. In the 1550s BC, there were "treatment rooms" where remedies for diseases were sought through the use of medicines, ointments, and other treatment methods derived from plants. It is also known that the Sumerians had similar health centers resembling pharmacies around 2100 BC [1]. During the Middle Ages, healing services were generally carried out using medicines prepared from herbs by priests and monks. Pharmacies were associated with health establishments and monasteries, which served as hospitals of that era and operated together [2].

The modern concept of pharmacy was established in the 19th century with the advancement of chemical science and the production of pharmaceutical drugs. The first professionally oriented pharmacy school, the Philadelphia College of Pharmacy, was founded in 1821 in Philadelphia, Pennsylvania [3]. In the following years, the Industrial Revolution and the development of mass-production technology also had an impact on drug production. Pharmacists started buying and selling mass-produced drugs instead of manually producing them [4]. As a result, the 20th century became a period of great advancements in pharmacy. Understanding the chemical structure of drugs and synthesizing new drugs allowed pharmacists to play a more active role in ensuring that patients use medications correctly, increasing their effectiveness and safety, and managing side effects [5, 6]. In the 21st century, the practice of pharmacy underwent a transformation to assume a role in general healthcare services and preventive care. Genomics and personalized medicine have had a significant impact on individualizing and optimizing drug treatment. This period is also marked by the rise of digital technologies such as e-health and telepharmacy [7].

To examine the history of pharmacy in Turkey, it is appropriate to start with the Ottoman Empire and mention the opening of the Pharmacy Class by Austrian Dr. Charles Ambroise Bernard in 1839, marking the beginning of pharmacy education [8]. The Pharmacy Class initially provided a 2-year education, which was later extended to 3 years. In 1867, a Pharmacy Class was established at the Civil Medical School (Mekteb-i Tıbbiye-i Mülkiye-i Şâhâne) [9]. In 1909, the Military and Civil Medical Schools were merged, but pharmacy education continued [10]. With the establishment of pharmacy schools, two types of pharmacists emerged: apprentices and degree holders. First-class pharmacists were individuals who completed their education, obtained a diploma, and had the right to open a pharmacy. Second-class pharmacists were those who worked as apprentices and journeymen and obtained a work certificate through an examination [11]. Pharmacy education has been under the influence of France for a long time due to the fact that Turkish physicians received education in France since the Ottoman era [12]. During the Republic period, the importance of pharmacy schools increased, and regulations were made. In 1960, the Faculty of Pharmacy was established at Ankara University [13].

Like many countries around the world, Turkey also carries out numerous digital transformation activities in the healthcare sector, which impact pharmacy services. Digital transformation now offers significant potential in terms of information management and data analytics in the field of pharmacy. Electronic

prescription systems enable the digital recording of patient information and the automation of dispensing processes [14]. This enhances patient safety by reducing risks such as incorrect dosages and drug interactions [15]. The Pharmacy Information Systems digital platform, initiated with the Health Transformation Project and implemented by the Ministry of Health in 2012, aims to make medication distribution and consumption more transparent, traceable, and efficient. Examples of such systems facilitate processes such as prescription management and medication tracking while also making positive contributions to public health [14]. Pharmacy Information Systems in Turkey is an electronic monitoring system that allows the tracking of both prescription and over-the-counter drug sales and distribution. It enables pharmacists and even other healthcare providers to access information about patients' medication usage quickly and securely [16]. Additionally, it plays a regulatory role in ensuring that pharmacies and pharmaceutical companies in Turkey operate in compliance with regulations [17].

Pharmacy practice and drug distribution in Türkiye have become highly digitized in the present day. The adoption of Pharmacy Information Systems is part of Turkey's investments in telepharmacy and other e-health applications, reflecting the country's efforts to modernize its healthcare services [18]. Moreover, it is crucial to establish the necessary technological infrastructure and ensure user familiarity with these systems for their effective utilization [19]. As a result, pharmacy education and continuous professional development programs in Türkiye particularly focus on topics related to multidisciplinary collaboration in healthcare, such as other areas involved in digitalization, healthcare management, and health policy [20-22].

While electronic information systems are widespread in pharmacies, the emerging need is to identify and address pharmacists' satisfaction and problems with these systems. This is of great importance in improving the quality and efficiency of healthcare services [23]. It will not only improve the working conditions of pharmacists but also have a positive impact on patient safety and health outcomes [24]. With electronic information systems, pharmacists can electronically process prescriptions, control drug interactions, automate inventory management, and other crucial pharmacy processes. These systems will enable pharmacists to access patient information more quickly and easily, reduce medication errors, and enhance medication safety. As a result, it is expected that there will be improved workflow and time savings for pharmacists [25, 26].

Based on this information, the aim of the study is to perform a qualitative evaluation of a specific group of pharmacists' use of Pharmacy Information Systems. The study seeks to understand these pharmacists' general opinions about the information systems they use, the challenges they encounter while using these systems, and the impact of this situation on their professional practices. Identifying potential barriers to the use of Pharmacy Information Systems and providing recommendations for pharmacists to benefit more effectively from these systems are aimed at generating policy and implementation suggestions based on the findings of this research.

## 2 Methodology

The research was conducted at 15 pharmacies in the Zeytinburnu district of Istanbul, Türkiye. The data collection period for the research was from May 1st to May 31st, 2023. During this period, there were 106 pharmacies in the area, but it is stated in the literature that there is no need for a specific sample calculation for qualitative research [27]. Therefore, a purposive sampling method was used to select the 15 pharmacies included in the research. Pharmacies were chosen based on a variety of criteria, including their location within the district, the population they serve, and the number of prescriptions they fill. This method is commonly used in qualitative research to ensure that the selected sample is most appropriate to answer the research question [28]. Qualitative research, unlike quantitative research, does not rely on reaching a specific sample size. Rather, it uses a concept known as "saturation." This refers

to the stage in data collection when additional data does not provide new insights or information. The tricky part is that saturation is usually identified during or after the data analysis phase, even though researchers often have to justify their sample size before collecting data. A range of studies suggest that for a qualitative study, conducting 15 interviews can be ample. Morgan et al. [29] showed that almost no new concepts emerged after 20 interviews. Furthermore, they found that the majority of new data emerged from the initial five to six in-depth interviews, with about 80% to 92% of all concepts being identified within the first 10 interviews. Supporting this, research by Guest et al. [30] proposed that conducting 6 to 12 interviews often suffices to achieve saturation. This, along with similar studies, suggests that typically, anywhere between 10 and 20 interviews are enough to encompass most themes and concepts. When the population under study is relatively homogeneous, it's likely that two to three focus group discussions will capture approximately 80% of the themes on a given topic. Additionally, we believe that our choice of participants from the same district in our study contributed to the homogeneity in this regard. It's important to note that these sample sizes apply per sub-population of interest and are applicable to both interviews and focus groups. Thematic saturation can be influenced by various factors, and thus, sample size should be adjusted as necessary [29, 30].

The data was collected from pharmacy owners or responsible pharmacists. Pharmacists were informed that the interviews would be recorded and their participation was voluntary. The interview questions were predetermined and shared with the pharmacy managers in an interview guide. This guide served as the basis for our data collection. During the interviews, demographic information such as the participants' name, age, pharmacy name, gender, and years of experience in the profession were also collected to better understand the background of the participants. Participants were assured that their names and surnames would be coded with initials for use in a scientific study and would not be shared with third parties. The questions asked to pharmacists regarding their satisfaction with pharmacy information systems are as follows:

- Are you satisfied with the pharmacy information systems?
- What aspects are you satisfied with?
- What areas do you think can be improved or where do you encounter the most problems?
- Is there anything you would like to add in general regarding information systems?

Firstly, all the interview data was meticulously read, and notes were taken to determine initial impressions. This stage was the familiarization with the data phase. Subsequently, the data was categorized. A short word or phrase that represented a specific theme or idea was assigned, creating a label for each piece of data. After this process, the categorizing was placed under themes that express themselves broadly and clearly. During the categorization process, categories combined with themes aimed to find broad meanings and create patterns. Accordingly, it was completed with three categories under each two themes. These are as follows:

**Theme 1:** Perceptions and Thoughts on Pharmacy Information Systems

- *Category 1A:* System Satisfaction of Interviewees
  - *Codes:* Convenience, Functionality
- *Category 1B:* Areas of Improvement
  - *Codes:* Error, Integration, Usability issues
- *Category 1C:* Impact of the System on Professional Practices
  - *Codes:* Tracking, Drug inventory control, Sales

**Theme 2:** Challenges in Using Pharmacy Information Systems

- *Category 2A:* Technical Issues

    - *Codes:* System issues, Performance during update time, Slow performance
- *Category 2B:* User Experience of Events Encountered
    - *Codes:* Unfair penalties, Lack of warnings, Physician-related issues
- *Category 2C:* Interaction with Other Systems
    - *Codes:* Price/payment systems, Warehouse systems, Physician systems

Ethical approval for the research was obtained from the Istanbul Arel University Ethics Committee with the notification and decision of E-52857131-050.06.04-271561 dated 28.04.2023, and the decision number 2023/09 of the 22nd meeting. All authors declare that the study was approved by the relevant committee or conducted in accordance with the principles of the Helsinki Declaration.

## 3 Results and Discussion

Table 1 presents coded information on interviewees and pharmacies, including age, gender, years of professional experience, and frequency data.

**Table 1:** *Age, gender, years of professional experience, and coded information of participants and pharmacies*

| Rank | Name (Code) | Pharmacy Name (Code) | Age | Gender | Years of Professional Experience |
|---|---|---|---|---|---|
| 1. | H. A. | H. E. | 26 | Female | 6 Months |
| 2. | A. Y. | Ş. E. | 44 | Male | 25 Years |
| 3. | Ü. Ş. | E. E. | 50 | Male | 25 Years |
| 4. | D. K. | D. E. | 49 | Male | 6 Years |
| 5. | T. Z. | T. E. | 45 | Female | 24 Years |
| 6. | Ş. A. | S. E. | 23 | Female | 1 Years |
| 7. | Y. S. | N. E. | 70 | Female | 40 Years |
| 8. | S. T. | A. E. | 63 | Female | 33 Years |
| 9. | Ö. A. | Z. E. | 38 | Male | 23 Years |
| 10. | M. S. | Y. Ş. E. | 22 | Male | 2 Years 6 Months |
| 11. | O. A. | N. E. | 24 | Male | 3 Years |
| 12. | M. Ç. Ç. | B. E. | 32 | Male | 16 Years |
| 13. | E. Ş. | S. E. | 25 | Female | 7 Years |
| 14. | D. Ö. | S. E. | 41 | Female | 23 Years |
| 15. | M. T. A. | K. E. | 20 | Male | 1 Years 6 Months |

The ranking section in Table 1 also indicates the order of visiting pharmacies. The ages of the interviewees range from 20 to 63. The years of professional experience vary from 6 months to 40 years (Table 1).

**Table 2:** *Descriptive information of the participants*

| Features | Participants |
|---|---|
| **Gender** | |
| Male | 8 |
| Female | 7 |
| **Working in the profession** | |
| 0 - 1 years | 2 |
| 1 – 5 years | 3 |
| 5 – 15 years | 2 |
| 15 - 25 years | 6 |
| 25 + years | 2 |
| **Age** | |
| 18 – 24 | 5 |
| 25 - 34 | 2 |
| 35 – 45 | 4 |
| 46+ | 4 |

Of the pharmacy owners and pharmacy workers participating in the study, 8 are male and 7 are female. Two individuals have 0-1 years of professional experience, three have between 1-5 years, two have between 5-15 years, six have between 15-25 years, and two have more than 25 years of professional experience (Table 2).

The topics are grouped into 2 themes, each consisting of 3 categories. Based on the responses, the themes are named "Perceptions and Thoughts on Pharmacy Information Systems" and "Challenges Encountered in Using Pharmacy Information Systems". Table 3, 4, and 5 examine the 3 categories within the theme of Perceptions and Thoughts on Pharmacy Information Systems.

**Table 3:** *System Satisfaction of Interviewees*

| | 1A | |
|---|---|---|
| | Convenience (11) | Functionality (11) |
| 1 | + | + |
| 2 | + | + |
| 3 | + | + |
| 4 | | |
| 5 | + | + |
| 6 | + | + |
| 7 | | + |
| 8 | + | + |
| 9 | + | |
| 10 | + | + |
| 11 | + | + |
| 12 | | |
| 13 | + | + |
| 14 | + | + |
| 15 | | |

The interviewees in study expressed a high degree of satisfaction with the use of information systems in their pharmacies, particularly praising their ease of use and practicality. For instance, Interviewee 2 noted their satisfaction with the Ilon system, highlighting its user-friendly nature. This sentiment was echoed by Interviewee 5, who appreciated the system's speed and simplicity, which enabled them to provide medication to customers promptly. Similarly, Interviewee 6 found the Ilon system beneficial

for its display of prescribed medications, while Interviewee 7 expressed satisfaction due to the system's lack of complications. Interviewee 8 appreciated the system's ability to streamline their work, allowing them to register patients and access information easily. Interviewee 9 found the Medula system to be an added convenience. Further, Interviewee 10 and 11 both expressed satisfaction with the system's ease and practicality. Interviewee 13 highlighted the system's ability to facilitate fast and convenient record-keeping. Interviewee 14 noted the ability to access comprehensive medication information by scanning barcodes in their program (Table 3). In a study conducted in Amman, it was found that the adoption of information technology in chain pharmacies had a positive impact on pharmacists' job satisfaction, and electronic system training was found to be beneficial in improving work processes [25]. In the interviews conducted with 15 pharmacists in this study, satisfaction based on the benefits of information systems, particularly in terms of ease of use and functionality, was mostly expressed. This indicates that information systems have the ability to provide practical solutions.

**Table 4:** *Areas of Improvement*

| | 1B | | |
|---|---|---|---|
| | Errors (9) | Integration (7) | Usability issues (3) |
| 1 | | | |
| 2 | + | + | |
| 3 | | | |
| 4 | + | + | + |
| 5 | | | |
| 6 | + | + | |
| 7 | + | | |
| 8 | + | | |
| 9 | | + | |
| 10 | + | | |
| 11 | | | |
| 12 | + | + | + |
| 13 | + | | |
| 14 | | + | + |
| 15 | + | + | |

While the interviewees in study generally expressed satisfaction with the use of information systems in their pharmacies, they also highlighted several challenges and areas for improvement. Interviewee 2, for instance, pointed out the lack of integration between medication reports and prescription information. This issue was also raised by Interviewee 4, who further criticized the SSI for imposing fines despite the lack of integration. Interviewee 4 also noted the system's failure to provide warnings for medications that are not reimbursed together, leading to automatic payments once the medication is provided. This concern was echoed by Interviewee 6, who attributed the problem to integration issues. System interruptions were reported by Interviewee 7, while Interviewee 9 mentioned instances of being unable to access medication or patient information. Interviewee 10 expressed frustration over bearing the cost for errors caused by the SSI. Interviewee 12 criticized the system for its lack of user-friendliness, attributing this to its age. They also mentioned having to juggle three different systems: their own warehouse system, the Medula system, and the prescription system. They particularly highlighted issues with the Medula system, describing it as old, basic, and not user-friendly compared to more advanced government e-applications. Finally, Interviewee 13 reported occasional system crashes and failures, which created problems for their operations. These findings underscore the need for improvements in the current information systems used in pharmacies, particularly in terms of integration, user-friendliness, and reliability (Table 4).

In a study conducted in Türkiye, the e-prescription system was examined using eight constructs, and it was found that pharmacists and physicians expressed moderate levels of satisfaction. The study also identified that the facilitating conditions and social influence of the system were important factors, and user dependency was found to be a predictive variable [28]. In a study conducted in Malaysia, the average satisfaction scores for pharmacy information systems in a group primarily consisting of pharmacists, ranging from 1 to 5 on a scale, were interpreted as satisfactory, with scores ranging from 3.66 to 4.13 [31]. In this study, the interviewed pharmacists expressed significant dissatisfaction with errors and integration issues. Additionally, three participants described the system as being ineffective.

**Table 5:** *Impact of the System on Professional Practices*

| | 1C | | |
|---|---|---|---|
| | Tracking (8) | Drug Inventory Control (5) | Sales (3) |
| 1 | + | + | + |
| 2 | + | + | |
| 3 | | | + |
| 4 | + | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | + | | |
| 9 | + | + | |
| 10 | | | |
| 11 | + | | + |
| 12 | | | |
| 13 | + | | |
| 14 | | + | |
| 15 | + | + | |

Interviewees provided a range of perspectives on the use of information systems in their pharmacies, highlighting both the benefits and challenges they encountered. Interviewee 2 expressed satisfaction with the medication tracking system. For instance, Interviewee 2 found value in the medication tracking system, stating, "We are most satisfied with the medication tracking system." However, they also highlighted some issues, noting, "As a result of an approved medication later appearing incomplete or inadequate elsewhere, we face challenges.". Interviewee 3 found the system quite sufficient for making sales, while Interviewee 4 questioned the utility of the tracking feature. Interviewee 6 appreciated the system's ability to track and display the medications used by patients, which they found expedited their work. Similarly, Interviewee 8 valued the system's ability to register patients and easily access information. Interviewee 11 noted that the system facilitated good sales and maintained accounts well. Interviewee 14 appreciated the ease of accessing key information such as the price and expiration date of medications. However, not all feedback was positive. Interviewee 15 reported issues with finding medications due to the system not being up-to-date, indicating a need for improvements in system maintenance and updating. These varied responses underscore the complexity of implementing information systems in pharmacies, with different users experiencing different benefits and challenges. They highlight the importance of ongoing system evaluation and improvement to ensure that these tools effectively support pharmacy operations (Table 5).

A study investigating the adoption of e-prescription in Nigeria included four hospitals as samples, and it was found that the system was cost-effective, but they were undecided about its technical feasibility [33]. Another study conducted in Norway found that individuals who were able to adapt to digitalization and utilize the tools well played an important role in electronic prescriptions and pharmacy services

[34]. Among the 15 pharmacists participating in this study, there was a divergence of opinions regarding the improvement of professional practice with the tracking system. It was noted that sales were generally satisfactory. Participants also expressed differing opinions when it came to the drug inventory system. Accordingly, it was observed that the system had certain issues for the participants in our study, and there is a need for improvement in aspects related to drug inventory and sales, which pose challenges to professional practice.

The categories and codes related to the theme "Challenges Encountered in Using Pharmacy Information Systems" are provided in Table 6, 7, and 8.

**Table 6:** *Technical Issues*

| | 2A | | |
|---|---|---|---|
| | System Issues (10) | Performance Update Times (5) | Slow (4) |
| 1 | | | |
| 2 | + | | |
| 3 | | | |
| 4 | | | |
| 5 | | + | |
| 6 | + | | |
| 7 | + | + | + |
| 8 | + | | |
| 9 | + | + | |
| 10 | + | | |
| 11 | | | |
| 12 | + | + | |
| 13 | + | | + |
| 14 | + | | + |
| 15 | + | + | + |

Interviewees identified several challenges related to system updates and overall usability of the information systems in their pharmacies. Interviewee 5, 7, and 9 all reported experiencing interruptions during system updates. For instance, Interviewee 5 shared, "During system updates, we often experience interruptions that disrupt our workflow." This sentiment was echoed by Interviewees 7 and 9, who also reported interruptions during updates. Similarly, Interviewee 6 noted connection issues and difficulties accessing certain features, particularly during update times. Interviewee 12 expressed frustration with the system's lack of improvement despite numerous updates since its release. They felt that the system still hadn't been properly enhanced. Interviewee 13 criticized the insurance system for its lack of user-friendliness, attributing this to its age. Finally, Interviewee 15 reported several issues, including system slowness, outdated prices, problems during updates, and difficulties logging into the system. These findings highlight the need for more seamless and effective system updates, as well as improvements in system speed and usability. They underscore the importance of ensuring that information systems in pharmacies are not only functional but also user-friendly and up-to-date (Table 6).

A study conducted by Mahoney et al. [37] examined 100,000 cases for the detection of drug allergies, overdoses, and the correction of incomplete or unclear orders, and it was determined that 73 errors that could jeopardize patient safety were identified. In this study, 15 pharmacists highlighted issues such as interruptions during updates, connection problems, difficulty accessing certain features, lack of sufficient development despite numerous updates, outdated insurance application, system slowness, occasional outdated prices, and login problems during update times.

**Table 7:** *User Experience of Events Encountered*

| | 2B | | |
|---|---|---|---|
| | Unfair penalties (4) | Lacking of Warnings (3) | Physician (2) |
| 1 | | | |
| 2 | + | + | |
| 3 | | | |
| 4 | + | | + |
| 5 | | | |
| 6 | + | + | |
| 7 | | + | |
| 8 | | | |
| 9 | | | |
| 10 | + | | |
| 11 | | | + |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |

The interviewees highlighted several challenges related to penalties imposed due to system errors or issues beyond their control. Interviewee 2 expressed concern over the significant penalties imposed for incomplete medication entries, which could amount to five times the price of the medication. Similarly, Interviewee 4 reported instances of penalties that were ten times higher than what the system accepted. They also shared an incident where a doctor's mistake in prescribing a strong medication without entering the LDL value led to a penalty for the pharmacy and put the patient's life at risk. Interviewee 6 noted that the system failed to provide warnings or show certain information, leading to automatic payments once the medication was provided. As a result, they received penalties from the SSI. Interviewee 10 identified unfair penalties as a significant problem and called for improvements in this area. Finally, Interviewee 11 pointed out that incorrect report writing by doctors created problems for them. These findings underscore the need for improvements in system functionality and error prevention, as well as fairer penalty policies. They also highlight the importance of effective communication and coordination between pharmacies and doctors to prevent mistakes and ensure patient safety. (Table 7).

In a statement released by the Majistral Pharmacists Association in 2020, due to the COVID-19 pandemic, it was stated that as a result of decisions taken at the 2020 meetings of the Advertising Board, which operates under the Ministry of Industry and Trade in Türkiye, unfair and legally inappropriate heavy administrative fines were imposed on some pharmacists [39]. It was expressed that these fines were based on inspections related to products such as masks, colognes, and disinfectants in pharmacies. It was also observed that 15 pharmacists participating in this study were systematically unfairly penalized.

**Table 8:** *Interaction with Other Systems*

| | 2C | | |
|---|---|---|---|
| | Price/Payment Systems (8) | Warehouse Systems (4) | Physician Systems (2) |
| 1 | | | |
| 2 | + | | |
| 3 | | | |
| 4 | + | + | + |
| 5 | | | |
| 6 | + | | |
| 7 | | | |
| 8 | + | | |
| 9 | | + | |
| 10 | + | | |
| 11 | | | + |
| 12 | + | + | |
| 13 | | | |
| 14 | + | | |
| 15 | + | + | |

Interviewee 4 pointed out that while the integration of medication reports and prescription information could be easily achieved, it was not currently being done. This lack of integration could potentially lead to inefficiencies or errors in pharmacy operations. Interviewee 6 noted that the system failed to provide alerts for medications that are not paid together, which could lead to financial discrepancies or penalties. Interviewee 8 reported instances where different programs showed different prices for the same medication, leading to confusion and potential errors. This highlights the need for consistency and accuracy in price information across different systems. Finally, Interviewee 15 criticized the system for not keeping prices up-to-date, which could lead to incorrect billing or customer dissatisfaction. For example, Interviewee 15 might have said, "*Just last week, a customer was charged an outdated price for their medication. When they realized the discrepancy, they were understandably upset. We had to spend a significant amount of time rectifying the issue and reassuring the customer. This could have been easily avoided if the system kept prices up-to-date.*" (Table 8).

These findings underscore the need for improvements in system integration, alert mechanisms, price consistency, and data accuracy. In a study conducted, it was determined that Merck's unsustainable policy in customer relationship management related to pharmacists was the integration in dispersed business processes, and ways to integrate customer relationship management into pharmacy information systems were sought [40].For the pharmacists participating in this study, issues such as misleading prices, problems with the warehouse system, and integration issues with the physician systems have been reported as significant problems. These interaction-related issues are thought to indicate problems with integration.

## 4 Conclusions

The integration of technology in healthcare, especially in pharmacies, has become crucial in the modern era. Systems such as the Ilon system, Medula, and others play a significant role in assisting pharmacists in their daily operations and interactions with patients. These systems aim to facilitate tasks, improve accuracy, and increase efficiency. However, there have been indications of potential shortcomings. Although the findings of this study are not generalizable due to the limited sample size of 15 pharmacies, discussions with these pharmacies revealed some deficiencies and challenges. Nevertheless, the majority of participating pharmacists in this study indicated their satisfaction with these systems.

From a positive perspective, pharmacists appreciate the convenience, ease of use, and practicality of these systems. They were particularly impressed with the quick access to medication information and patient data these systems offer, making it easy to provide medications to customers quickly and efficiently. The ability to track medications and maintain accounts effectively was also found to be beneficial.

However, the study also revealed some challenges that pharmacists face while using these systems. Despite the convenience they offer, these systems sometimes fail to provide an optimal user experience due to issues with updates, connection interruptions, and outdated designs. Some pharmacists mentioned the system's inability to alert for medications that are not paid together, which could lead to inadvertent errors and potential penalties. In addition, there were criticisms about the system being unable to display warnings for medications that are not reimbursed together. The system's slowness, and the fact that the prices are not always up-to-date, were also identified as areas of concern.

Another significant issue highlighted was the imposition of penalties due to discrepancies in prescriptions or medication reports. There were instances where pharmacists were penalized due to the doctor's mistakes or incomplete prescription information, indicating a lack of comprehensive integration between the systems used by doctors and pharmacists.

Based on the problems encountered in this study, we believe the following recommendations could be beneficial:

- Improve System Integration: It is vital to enhance the integration between different systems used by doctors and pharmacists to ensure seamless data exchange and reduce errors.
- Enhance User-Friendliness: The design and interface of these systems should be updated to be more user-friendly. It should provide all necessary warnings and alerts to avoid potential errors and penalties.
- Regular System Updates: Regular updates should be made to ensure the prices are current, and the system functions optimally. However, these updates should be done in a manner that minimizes disruptions to the pharmacists.
- Improve Penalty System: A review of the penalty system is needed. Pharmacists should not be penalized for mistakes made by doctors or due to system errors.
- Training and Support: Provide sufficient training to the pharmacists on the use of these systems and make sure they have access to timely support when needed.
- Establish a Feedback Mechanism: Establish a robust feedback mechanism where pharmacists can express their concerns and suggestions about the system. This feedback can be invaluable in making improvements to the system in future updates.

## 5 Declarations

### 5.1 Study Limitations

One of the main limitations of this study is that it was conducted exclusively in 15 pharmacies located in the Zeytinburnu district. The two reasons for this was accessibility due to time and financial constraints. This situation limits the generalization of the results to all pharmacies in Istanbul or Turkey. Regional differences and unique environmental factors create uncertainty as to whether the research results are applicable to pharmacies in different areas. Secondly, only pharmacy owners or responsible pharmacists were interviewed in the research. The opinions of pharmacy employees about information systems could provide a broader perspective on the general functioning of the systems and pharmacist

satisfaction. Therefore, it should be kept in mind that the research findings were obtained only from pharmacy owners and pharmacists. Thirdly, the research was designed with only a qualitative method. While this provides the capacity to deeply understand a specific situation, it can make measurement or generalization on a large scale difficult. The generalizability of qualitative data may be limited due to the size and selection of the sample. Finally, another limitation of this study is the method of data collection. The data were collected based on a predetermined set of questions. This can limit the way participants respond to certain questions and prevent the obtaining of more open and comprehensive answers. Considering these limitations, it is important to take these factors into account for accurate interpretation of the results. Future studies may spread to a broader geographical area to overcome these limitations and have a wider and more diverse sample. Also, getting feedback from pharmacy employees and diversifying data collection methods could be considered.

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### 5.3 Funding source

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### 5.4 Competing Interests

There is no conflict of interest in this study.

### 5.5 Authors' Contributions

Define the contribution of each researcher named in the paper to the paper.

**Corresponding Author (2nd) Salim Yılmaz:** Contribution to the article. (Developing ideas or hypotheses for the research and/or article, planning the materials and methods to reach the results, taking responsibility for the literature review during the research, taking responsibility for the creation of the entire manuscript or the main part, reworking not only in terms of spelling and grammar but also intellectual content or other contributions…)

**1. Author's Ömür Can Çam:** Contribution to the article. (Developing ideas or hypotheses for the research and/or article, taking responsibility for the experiments, organizing and reporting the data, taking responsibility for the explanation and presentation of the results, taking responsibility for the literature review during the research.)

**3. Author's Metin ATEŞ:** Contribution to the article. (reworking not only in terms of spelling and grammar but also intellectual content or other contributions…)

# 6 Human and Animal Related Study

## 6.1 Ethical Approval

Approval from the Istanbul Arel University Ethics Committee was obtained on 28.04.2023, with decision number: E-52857131-050.06.04-271561.

## 6.2 Informed Consent

Informed consent form was obtained from all participants for the study that they agreed to participate in the study.

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# E-Learning in Health: Investigation of Family Physicians' Acceptance and Use of Technology on Demographic Factors*

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## ABSTRACT

E-learning is the changing and renewing face of education in health, as in many other fields. Advancements in information and communication technologies allow the development of health professionals in continuous education. Since e-learning provides asynchronous learning opportunities to health professionals working in different geographical regions, it provides various opportunities for the career development of health professionals. One of Turkey's most significant e-learning projects in the health field was carried out by the Family Medicine Distance Education Centre (AHUZEM). The e-learning project prepared for family physicians aimed to provide much more accessible, effective, and faster training for family physicians. This study aims to reveal family physicians' adoption of e-learning applications according to demographic factors. In the study, the Unified Technology Acceptance and Use Model (UTAUT) developed by Venkatesh et al. (2003) by examining many theories and models was used as a data collection tool. In addition, the author integrated the attitude towards technology use dimension consisting of 4 questions into the model by examining the relevant literature. In addition, the research was organized according to a 5-point Likert-type scale. The data was obtained from 429 family physicians who agreed to participate in the online survey shared on social networks nationwide by convenience sampling. Whether there is a difference according to the demographic characteristics of the family physicians participating in the study was evaluated using the t-test and ANOVA. According to the results of the analyses, a significant difference was found in the intention to use e-learning and UTAUT based on factors such as age, specialty, working time, and e-learning experience. Nevertheless, there was no statistically significant disparity observed based on gender.

**Keywords:** E-learning, Family physicians, Technology use

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# Sağlıkta E-Öğrenme: Aile Hekimlerinin Teknoloji Kabul ve Kullanımının Demografik Faktörlere Göre Analizi

## ÖZ

E-öğrenme, diğer birçok alanda olduğu gibi sağlık eğitiminin de yeni ve değişen yüzüdür. Bilgi ve iletişim teknolojilerinin gelişimi, sürekli eğitimde sağlık profesyonellerinin gelişimine imkan tanımaktadır. E-öğrenme, farklı coğrafyalarda görev yapan sağlık profesyonellerinin gelişimi için asenkron eğitim imkanları sağladığı için çeşitli fırsatlar sunmaktadır. Sağlık sektöründe e-eğitim projesi olarak aile hekimlerimize yönelik Aile Hekimliği Uzaktan Eğitim Merkezi tarafından Türkiye'de gerçekleştirilen en büyük e-öğrenme projelerinden biridir. Bu çalışmanın amacı, aile hekimlerinin demografik faktörlere dayalı olarak e-öğrenme uygulamalarının benimseme düzeyini ortaya koymaktır. Çalışmada veri toplama aracı olarak Venkatesh ve ark. (2003) tarafından birçok teori incelenerek geliştirilen Birleşik Teknoloji Kabul ve Kullanım Modeli (BTKKM) kullanılmıştır. Ayrıca ilgili literatür taraması yapılarak 4 sorudan oluşan tutum boyutu yazarlar tarafından modele dahil edilmiştir. Araştırma 5'li Likert tipine göre düzenlenmiştir. Araştırmada veriler, kolayda örnekleme yöntemiyle sosyal ağlarda paylaşılan çevrimiçi ankete katılmayı kabul eden 429 aileden elde edilmiştir. Çalışmaya katılan aile hekimlerinin demografik özelliklere göre fark gösterip göstermediği ise t-testi ve ANOVA kullanarak değerlendirilmiştir. Analiz sonuçlarına göre; yaşa, uzmanlık alanına, çalışma süresine, e-öğrenme deneyimine göre kullanım niyetinde ve BTKKM'de anlamlı bir fark bulunmuş, ancak cinsiyete göre anlamlı bulunmamıştır.

**Anahtar Kelimeler:** E-öğrenme, Aile hekimleri, Teknoloji Kullanımı

## 1 Introduction

The development of medical education has undergone significant changes over the years. The focus on classical education in medical education in the 1910s evolved to Problem-Based Learning (PBL) in the 1970s [1]. However, the medical education process constantly evolves, and new challenges and demands emerge. There is also a growing recognition of the importance of lifelong learning and the need for continuous professional development throughout a physician's career, which continually triggers a change in medical education to address the changing healthcare environment, technological advances, and the evolving needs of patients and communities [2]. In the last ten years, e-learning application transformation and integration have been observed in medical education and many fields. E-learning is the use of Internet technologies to improve knowledge and performance. E-learning technologies allow users to personalize and adapt their learning experiences to meet their learning objectives. In the context of medical education, e-learning is almost as effective as traditional learning methods. It also has technical standards and peer review methods. Innovations in e-learning technologies enable personalizing learning, increasing users' interactions with each other, and transforming the role of the instructor. E-learning supports a move towards a direction in which educators are more involved as facilitators and learner assessors rather than as content distributors. This can trigger a transition that provides users with adaptive learning, encourages collaborative learning, and leads to the application of adult learning theory [3].

Today's medical educators may face different challenges than their predecessors when teaching tomorrow's physicians [2]. Traditional instructor-centered teaching is transforming into a learner-centered model that puts learners in control of their learning [3]. E-learning is becoming an increasingly important component of medical education. One particular area of e-learning in medical education that attracts attention is the use of virtual patients. Virtual patients are computer-based simulations that allow students to practice clinical reasoning skills. However, more research is needed to determine how to effectively use virtual patient etc., applications in medical education [4]. Overall, e-learning in medical

education is an exciting and dynamic field that requires creativity and adaptability [5]. Many studies have been conducted to determine the factors affecting users' adoption of e-learning systems in various sectors [6-9].

When the studies in the literature are examined, demographic factors are an essential subject of study in the field while examining technology acceptance and use in many fields. For example, in the study conducted by Chen et al., 2020, it was found that demographic characteristics such as gender, age, and level of education significantly affect the effects of the factors in the UTAUT model. The study drew attention to the importance of considering demographic factors when examining technology acceptance and use. It emphasized that demographic factors play a decisive role in shaping the results of studies conducted with the technology acceptance model [10]. However, there needs to be more studies to determine the technological acceptance of physicians in the health sector. For this reason, knowing the demographic variables according to which physicians differ in technology acceptance in the health sector will guide future projects and investments.

In line with this purpose, the following research question was asked in the study.

The answer to the question "Do the dimensions that make up the UTAUT model differ according to the socio-demographic characteristics of family physicians?" will be sought.

## 2 Methodology

The study aims to reveal the level of adoption of e-learning applications by family physicians according to demographic factors. For this purpose, the Unified Technology Acceptance and Use Model (UTAUT) developed by Venkatesh et al. [6], by examining many theories and models in the field [11-17], was used as a data collection tool the authors added the dimension of attitude towards technology use consisting of 4 questions to the model of 22 questions. A 5-point Likert-type scale was used in the study. It consists of 30 questions, including questions to measure the socio-demographic characteristics of the participants.

Family Medicine Distance Education Centre (AHUZEM) in Turkey was determined as the population of the study. AHUZEM is a center under the coordination of the Ministry of Health, Department of Public Health Education, where "Family Medicine Continuing Professional Development" training programs, including both in-service training and second-stage clinical training of transition to family medicine, are carried out for family physicians (22.000) [18]. In order to carry out the study properly, support was obtained from the Department of Family Medicine Education and Development and Family Medicine Associations. The study was conducted between 01/01/2013-28/02/2013, and 515 family physicians participated in the study, but 86 questionnaires were found to need to be filled in correctly, and 429 questionnaires were analyzed.

In order to determine the main factors determining the use of e-learning systems by family physicians, the Unified Technology Acceptance Model (UTAUT), one of the most comprehensive technology acceptance models in the relevant literature, was taken as a basis and adapted to Turkish conditions. Basically, four groups of variables can directly determine the acceptance of technology by users integrated from many theories in the related literature. These are; effort expectancy, performance expectancy, social impact, and facilitating conditions. The UTAUT is a comprehensive model that provides insight into the factors that influence the acceptance and use of technology. It has been widely applied in various contexts and has contributed to our understanding of user adoption behavior. However, due to the mandatory use of the e-learning system in healthcare by family physicians in

Turkey, the model needed to be adapted accordingly. As a requirement of this, the voluntariness moderator was excluded from the model. Considering that the use of e-learning systems in health is compulsory in our country, it would be essential to include the dimension of attitude toward using technology in the model to determine physicians' attitudes. These variables have started to be included in the studies in this field as new factors reflecting physicians' thoughts in the e-learning system. Hung, Chang, and Yu (2006) and Schaupp et al. (2010) also used their models of attitudes toward the use of technology to determine the effect of different factors on the use of e-learning systems [18,19].

## 3 Results

According to the results of the reliability analysis of the research in Table 1, Cronbach's Alpha (α) coefficient was determined as 0.96. Since this value is in the range of "0,80 ≤ α ≤ 1,00", it was determined that the dimensions forming the scale are suitable for validity [20].

In Table 1, it is determined that the findings related to the sub-dimensions of the scale have values above the minimum conditions required for reliability.

**Table 1:** *Reliability Analysis of the Scales Used in the Study*

| Dimensions | Number of Questions | Mean | SD | $\alpha$ |
|---|---|---|---|---|
| **Performance Expectation** | 7 | 3,49 | 0,945 | 0,934 |
| **Effort Expectation** | 4 | 3,69 | 0,858 | 0,843 |
| **Social Impact** | 4 | 3,23 | 0,884 | 0,801 |
| **Facilitating Conditions** | 4 | 3,64 | 0,792 | 0,786 |
| **Attitude Towards Using Technology** | 4 | 3,38 | 1,062 | 0,788 |
| **General** | 23 | 3,45 | 0,805 | 0,960 |

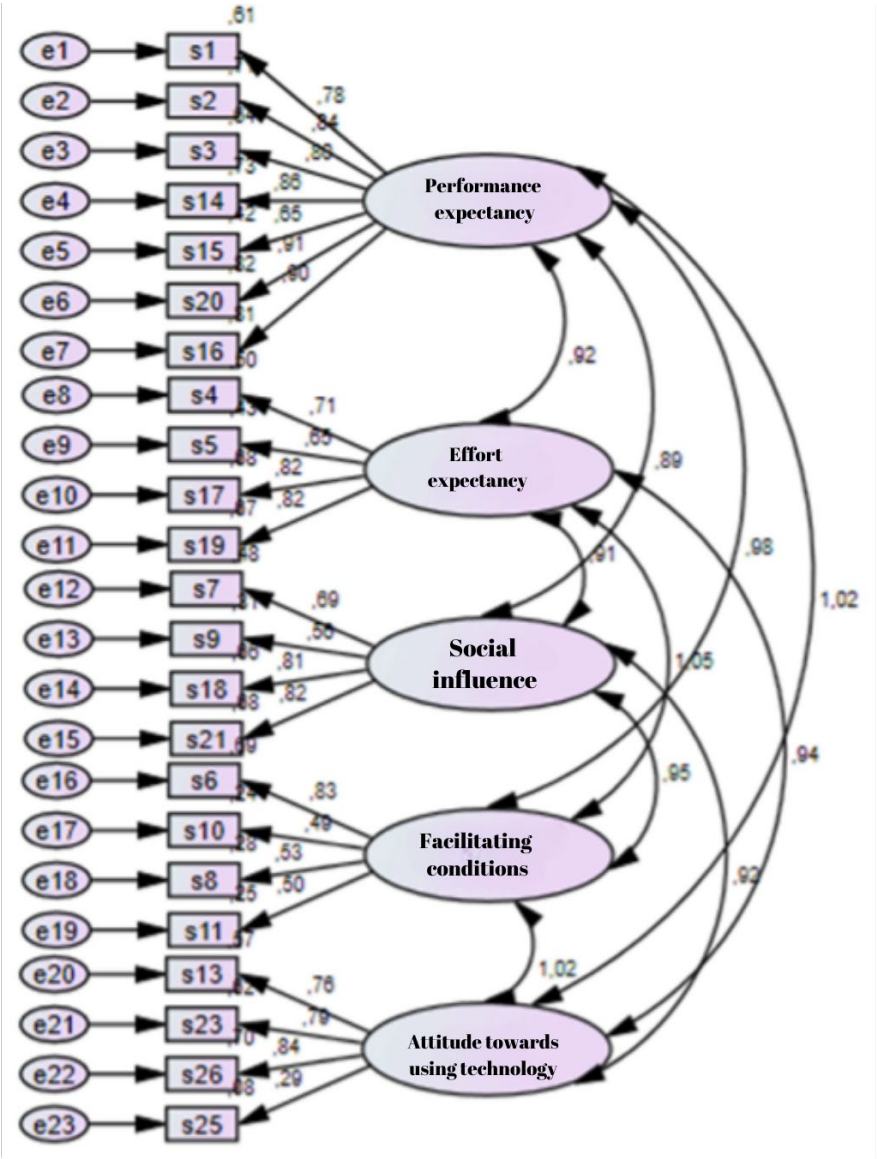


**Figure 1:** *Confirmatory Factor Analysis of the Model*

Generalized value ranges of the fit measures are given in Table 2 [21,22]. In addition, the fit indices obtained as a result of the CFA analysis of the study are given in Table 2. As can be seen, when Table 2 is analyzed, the fit indices obtained as a result of CFA analysis are Chi-Square/Df= 2,512, GFI= 0,904, AGFI=0,871, CFI=0,960, IFI=0,960, NFI=0,935, RMSEA=0,059, PGFI= 0,672 and AIC= 657,010. As can be seen when Figure 1 and Table 2 are analysed, the model generally provides a good fit according to the confirmatory factor analysis findings.

**Table 2:** *Acceptance Criterion Intervals for Goodness of Fit Indices and Confirmatory Factor Analysis Fit Indices of the Model Used in the Study*

| Fit Indices | Good Fit | Acceptable Fit | Estimated Model |
|---|---|---|---|
| RMSEA | 0<RMSEA<0,05 | 0,05≤RMSEA≤0,10 | 0,059 |
| NFI | 0,95≤NFI≤1 | 0,90≤NFI≤0,95 | 0,935 |
| NNFI | 0,97≤NNFI≤1 | 0,95≤NNFI≤0,97 | 0,950 |
| CFI | 0,97≤CFI≤1 | 0,95≤CFI≤0,97 | 0,960 |
| GFI | 0,95≤GFI≤1 | 0,90≤GFI≤0,95 | 0,904 |
| AGFI | 0,90≤AGFI≤1 | 0,85≤AGFI≤0,90 | 0,871 |

Whether there is a differentiation regarding the use of technology acceptance according to the socio-demographic characteristics of the participants was tested with Independent t-test and One Way Anova. In the process of analysing the hypotheses, the statistical significance value was accepted as p<0.05.

When Table 3 is examined; according to the gender variable, it is seen that among the physicians participating in the research, the rate of men (64.1%) is higher than women (35.9%) and the majority of them are general practitioners (91%) according to their speciality areas. According to the age variable, it is seen that physicians are mostly gathered in 31-45 age groups. According to the duration of service, the most predominant groups of the physicians participating in the study were found to have served between 16-20 years (21.2%) and 20 years (26.5%).

**Table 3:** *Demographic Data of Participants*

| Demographic Characteristics | | Number | % | Demographic Characteristics | | Number | % |
|---|---|---|---|---|---|---|---|
| **Gender** | **Male** | 275 | **Specialisation status** | **Specialisation Status** | **General Practitioner** | 390 | 91,0 |
| | **Woman** | 154 | 35,9 | | **Family Physician Specialist** | 39 | 9,0 |
| **Term of Office** | ≤5 | 51 | 11,8 | **Age** | ≤30 | 36 | 8,3 |
| | 6-10 | 85 | 19,8 | | 31-35 | 94 | 21,9 |
| | 11-15 | 88 | 20,5 | | 36-40 | 98 | 22,8 |
| | 16-20 | 91 | 21,2 | | 41-45 | 96 | 22,3 |
| | ≥20 | 114 | 26,5 | | ≥46 | 105 | 24,6 |

### 3.1 Changes in the dimensions of the UTAUT model according to the gender of family physicians

In Table 4, according to the results of the t-test conducted on the variables related to the acceptance and use of e-learning by family physicians according to gender, it was determined that there was no statistically significant difference (p>0,005).

**Table 4:** *t Test Results of E-Learning Acceptance and Usage by Gender*

| Dimensions | Gender | N | Mean | SD | t | p |
|---|---|---|---|---|---|---|
| **Performance Expectation** | Female | 167 | 3,43 | 0,934 | 0,939 | 0,606 |
| | Male | 262 | 3,52 | 0,952 | | |
| **Effort Expectation** | Female | 167 | 3,67 | 0,873 | 0,316 | 0,872 |
| | Male | 262 | 3,70 | 0,851 | | |
| **Social Impact** | Female | 167 | 3,27 | 0,868 | 0,811 | 0,244 |
| | Male | 262 | 3,20 | 0,894 | | |
| **Facilitating Conditions** | Female | 167 | 3,64 | 0,765 | 0,053 | 0,558 |
| | Male | 262 | 3,63 | 0,810 | | |
| **Attitude towards Using Technology** | Female | 167 | 3,35 | 1,042 | 0,575 | 0,585 |
| | Male | 262 | 3,41 | 1,076 | | |
| **E-learning Usage Intention** | Female | 167 | 3,69 | 0,878 | 0,901 | 0,227 |
| | Male | 262 | 3,78 | 0,957 | | |

## 3.2 Changes in the dimensions of the UTAUT model according to the speciality of family physicians

In Table 5, according to the t-test result to determine whether there is a difference in e-learning usage and acceptance variables according to the specialty of family physicians, it was determined that there was no difference (p>0,05).

**Table 5:** *T-test Results of E-learning Acceptance and Use According to Specialty*

| Dimensions | Specialty | N | Mean | SD | t | p |
|---|---|---|---|---|---|---|
| **Performance Expectation** | General Practitioner | 386 | 3,52 | 0,940 | 1,422 | 0,867 |
| | Family Physician Specialist | 43 | 3,29 | 0,980 | | |
| **Effort Expectation** | General Practitioner | 386 | 3,70 | 0,853 | 1,273 | 0,680 |
| | Family Physician Specialist | 43 | 3,53 | 0,902 | | |
| **Social Impact** | General Practitioner | 386 | 3,24 | 0,888 | 1,315 | 0,287 |
| | Family Physician Specialist | 43 | 3,06 | 0,838 | | |
| **Facilitating Conditions** | General Practitioner | 386 | 3,65 | 0,794 | 1,334 | 0,701 |
| | Family Physician Specialist | 43 | 3,48 | 0,763 | | |
| **Attitude Towards Using Technology** | General Practitioner | 386 | 3,41 | 1,061 | 1,38 | 0,833 |
| | Family Physician Specialist | 43 | 3,17 | 1,063 | | |
| **E-learning Usage Intention** | General Practitioner | 386 | 3,76 | 0,916 | 0,701 | 0,137 |
| | Family Physician Specialist | 43 | 3,65 | 1,023 | | |

## 3.3 Variation of the Dimensions Composing the ICPC Model according to the Age of Family Physicians

As a result of the analysis detailed in Table 6, it was determined that there was a statistically significant difference in all dimensions affecting e-learning usage intentions of physicians according to their age groups (p<0,005). Tukey HSD test was performed to determine which age groups the difference was between.

According to the findings of the analysis, it was found that the difference in all dimensions was caused

by family physicians the age group of 46 and over and family physicians who were younger than 30 years old. Other differences are also shown in the table 6. In addition, it was determined that the social impact dimension of the family physicians participating in the study decreased with increasing age.

**Table 6:** *ANOVA Results of E-Learning Acceptance and Use According to Age*

| Dimensions | Age | n | Mean | SD | F | p | Post. Hoc |
|---|---|---|---|---|---|---|---|
| **Performance Expectation** | <30 | 39 | 3,54 | 1,061 | 4,032 | 0,003 | 1-5 p=0,036<br>2-5 p=0,000<br>3-5 p=0,004<br>4-5 p=0,002 |
| | 31-35 | 93 | 3,65 | 0,798 | | | |
| | 36-40 | 99 | 3,55 | 0,914 | | | |
| | 41-45 | 96 | 3,58 | 0,962 | | | |
| | >46 | 102 | 3,17 | 0,980 | | | |
| | Total | 429 | 3,49 | 0,945 | | | |
| **Effort Performance** | <30 | 39 | 3,82 | 0,853 | 6,832 | 0,000 | 1-5 p=0,001<br>2-5 p=0,000<br>3-5 p=0,000<br>4-5 p=0,000 |
| | 31-35 | 93 | 3,86 | 0,730 | | | |
| | 36-40 | 99 | 3,77 | 0,797 | | | |
| | 41-45 | 96 | 3,78 | 0,810 | | | |
| | >46 | 102 | 3,31 | 0,970 | | | |
| | Total | 429 | 3,69 | 0,858 | | | |
| **Social Impact** | <30 | 39 | 3,24 | 0,845 | 7,066 | 0,000 | 1-5 p=0,023<br>2-5 p=0,000<br>3-5 p=0,000<br>4-5 p=0,000 |
| | 31-35 | 93 | 3,50 | 0,750 | | | |
| | 36-40 | 99 | 3,30 | 0,945 | | | |
| | 41-45 | 96 | 3,26 | 0,865 | | | |
| | >46 | 102 | 2,87 | 0,867 | | | |
| | Total | 429 | 3,23 | 0,884 | | | |
| **Facilitator Conditions** | <30 | 39 | 3,61 | 0,825 | 5,990 | 0,000 | 1-5 p=0,049<br>2-5 p=0,000<br>3-5 p=0,000<br>4-5 p=0,000 |
| | 31-35 | 93 | 3,81 | 0,697 | | | |
| | 36-40 | 99 | 3,71 | 0,811 | | | |
| | 41-45 | 96 | 3,73 | 0,712 | | | |
| | >46 | 102 | 3,32 | 0,838 | | | |
| | Total | 429 | 3,64 | 0,792 | | | |
| **Attitude Towards Using Technology** | <30 | 39 | 3,43 | 1,165 | 4,278 | 0,002 | 1-5 p=0,041<br>2-5 p=0,000<br>3-5 p=0,007<br>4-5p=0,001 |
| | 31-35 | 93 | 3,58 | 0,889 | | | |
| | 36-40 | 99 | 3,42 | 1,034 | | | |
| | 41-45 | 96 | 3,51 | 1,119 | | | |
| | >46 | 102 | 3,02 | 1,072 | | | |
| | Total | 429 | 3,38 | 1,062 | | | |
| **Intention to Use e-learning** | <30 | 39 | 3,82 | 1,037 | 4,649 | 0,001 | 1-5 p=0,019<br>2-5 p=0,002<br>3-5 p=0,003<br>4-5 p=0,000 |
| | 31-35 | 93 | 3,82 | 0,659 | | | |
| | 36-40 | 99 | 3,80 | 0,873 | | | |
| | 41-45 | 96 | 3,93 | 0,932 | | | |
| | >46 | 102 | 3,42 | 1,064 | | | |
| | Total | 429 | 3,75 | 0,927 | | | |

### 3.4 The change in the dimensions of the UTAUT model according to the working period of family physicians

According to the results of the analyses based on the working time groups of family physicians in Table 7, it was found that there was a difference in all dimensions ($p<0.05$).

According to the findings obtained, it was determined that the difference in all dimensions was mostly caused by family physicians with 21 and more years of working time and family physicians with less than 5 years of working time.

**Table 7:** *ANOVA Results of E-Learning Acceptance and Use According to Working Period*

| Dimensions | Working Period | n | Mean | SD | F | p. | Post Hoc |
|---|---|---|---|---|---|---|---|
| **Performance Expectation** | <5 | 60 | 3,54 | 1,007 | 4,392 | 0,002 | 1-5 p=0,018<br>2-5 p=0,000<br>3-5 p=0,007<br>4-5p=0,006 |
| | 6-10 | 88 | 3,71 | 0,740 | | | |
| | 11-15 | 97 | 3,53 | 0,982 | | | |
| | 16-20 | 77 | 3,56 | 0,963 | | | |
| | >21 | 107 | 3,18 | 0,955 | | | |
| | Total | 429 | 3,49 | 0,945 | | | |
| **Effort Expectation** | <5 | 60 | 3,82 | 0,830 | 6,084 | 0,000 | 1-5 p=0,001<br>2-5 p=0,000<br>3-5 p=0,001<br>4-5 p=0,001 |
| | 6-10 | 88 | 3,89 | 0,645 | | | |
| | 11-15 | 97 | 3,73 | 0,824 | | | |
| | 16-20 | 77 | 3,76 | 0,917 | | | |
| | >21 | 107 | 3,35 | 0,933 | | | |
| | Total | 429 | 3,69 | 0,858 | | | |
| **Social Impact** | <5 | 60 | 3,28 | 0,840 | 6,384 | 0,000 | 1-5 p=0,009<br>2-5 p=0,000<br>3-5 p=0,001<br>4-5 p=0,019<br>2-3 P=0,039<br>2-4 P=0,020 |
| | 6-10 | 88 | 3,53 | 0,724 | | | |
| | 11-15 | 97 | 3,27 | 0,964 | | | |
| | 16-20 | 77 | 3,22 | 0,926 | | | |
| | >21 | 107 | 2,91 | 0,834 | | | |
| | Total | 429 | 3,23 | 0,884 | | | |
| **Facilitator Conditions** | <5 | 60 | 3,66 | 0,802 | 4,917 | 0,001 | 1-5 p=0,022<br>2-5 p=0,000<br>3-5 p=0,005<br>4-5 p=0,005 |
| | 6-10 | 88 | 3,84 | 0,671 | | | |
| | 11-15 | 97 | 3,68 | 0,834 | | | |
| | 16-20 | 77 | 3,70 | 0,728 | | | |
| | >21 | 107 | 3,37 | 0,825 | | | |
| | Total | 429 | 3,64 | 0,792 | | | |
| **Attitude Towards Using Technology** | <5 | 60 | 3,46 | 1,125 | 4,143 | 0,003 | 1-5 p=0,019<br>2-5 p=0,000<br>3-5 p=0,030<br>4-5 p=0,007 |
| | 6-10 | 88 | 3,64 | 0,862 | | | |
| | 11-15 | 97 | 3,38 | 1,093 | | | |
| | 16-20 | 77 | 3,48 | 1,020 | | | |
| | >21 | 107 | 3,06 | 1,114 | | | |
| | Total | 429 | 3,38 | 1,062 | | | |
| **E-learning Usage Intention** | <5 | 60 | 3,82 | 0,936 | 4,703 | 0,001 | 1-5 p=0,013<br>2-5 p=0,000<br>3-5 p=0,000 |
| | 6-10 | 88 | 3,92 | 0,602 | | | |
| | 11-15 | 97 | 3,69 | 1,009 | | | |
| | 16-20 | 77 | 3,95 | 0,822 | | | |
| | >21 | 107 | 3,45 | 1,063 | | | |
| | Total | 429 | 3,75 | 0,927 | | | |

### 3.5 The Change of the Dimensions Composing the UTAUT Model According to the E-Learning Experiences of Family Physicians.

When Table 8 is analyzed, it is found that there is a statistically significant difference only in terms of the intention to use e-learning according to the E-learning experiences of family physicians (t=2,030; p<0,01).

**Table 8:** *t Test Results of E-Learning Acceptance and Usage According to E-Learning Experience*

| Dimensions | E-learning Experience | n | Mean | SD | t | p |
|---|---|---|---|---|---|---|
| **Performance Expectation** | **Yes** | 173 | 3,59 | 0,965 | 1,818 | 0,763 |
| | **No** | 256 | 3,42 | 0,927 | | |
| **Effort Expectation** | **Yes** | 173 | 3,81 | 0,871 | 2,467 | 0,677 |
| | **No** | 256 | 3,60 | 0,841 | | |
| **Social Impact** | **Yes** | 173 | 3,37 | 0,887 | 2,736 | 0,844 |
| | **No** | 256 | 3,13 | 0,870 | | |
| **Facilitating Conditions** | **Yes** | 173 | 3,84 | 0,744 | 4,394 | 0,275 |
| | **No** | 256 | 3,50 | 0,796 | | |
| **Attitude Towards Using Technology** | **Yes** | 173 | 3,51 | 1,051 | 2,003 | 0,315 |
| | **No** | 256 | 3,30 | 1,063 | | |
| **E-learning Using Intention** | **Yes** | 173 | 3,85 | 0,878 | 2,030 | **0,010** |
| | **No** | 256 | 3,67 | 0,953 | | |

## 4 Discussion

According to the results of the analyses, a significant difference was found in the intention to use e-learning and UTAUT according to age, specialty, working time, and e-learning experience. However, no significant difference was found according to gender. The UTAUT model has been widely studied to understand the factors affecting the acceptance and use of technology. It is emphasized that gender affects technology acceptance and usage behavior. Venkatesh & Davis (2000) study showed that the extended model is strongly supported for all four systems regardless of gender [7].

However, another recent study by Afrizal & Wallang (2021) also investigated the effect of gender on the intention to use e-government using a modified version of the UTAUT. The study found that gender did not significantly affect the intention to use e-government [23]. Although these studies suggest that gender may not directly affect technology acceptance and use, it is essential to note that individual differences and cultural factors may still play a role. In conclusion, the research on the impact of gender on technology acceptance and use based on the UTAUT model suggests that gender may not directly impact technology acceptance and use behavior. However, it is essential to consider individual differences and cultural factors that may interact with gender to influence the acceptance and use of technology.

Venkatesh & Bala (2008) investigated e-banking adoption in developing countries from a UTAUT perspective. The study found that age significantly moderates the relationship between performance expectancy and behavioral intention to use e-banking. This suggests that the effect of performance expectancy on behavioral intention may vary depending on age [24]. Furthermore, another study examined the impact of social factors on the adoption of e-government services, with age as a moderating factor. The study found that age moderates the relationship between social influence and intention to use e-government services [25]. This suggests that the impact of social factors on technology acceptance may differ across age groups. Overall, the literature suggests that age may moderate the relationship between certain factors of the UTAUT model and technology acceptance and usage behavior. However, the specific nature of this effect may vary depending on the context and technology being examined. Further research is needed to investigate these age-related differences and understand their impact on technology adoption and use. The results are in line with the literature.

Subhani et al. (2023) investigated technology acceptance in public sector universities, looking specifically at the mediating role of behavioral intention and the moderating effect of experience. The study found that experience moderated the relationship between the UTAUT model and employee behavior, suggesting that the impact of the model may vary depending on individuals' experience level [26]. E-learning is becoming an increasingly important component of medical education. It can allow the user to control their learning experience by providing access to content, allowing them to learn at their own pace, and tailoring their experience to meet individual learning goals. Research has indicated that e-learning is at least as effective as traditional instructor-led methods, such as lectures in various medical education contexts. However, it is still helpful for medical education students to see e-learning not as a replacement for traditional methods but as a complement to them and part of a blended learning strategy [3]. Increasingly, many different e-learning formats are being developed in medical education. Virtual patients are computer-based simulations that allow the user to practice clinical reasoning skills. [4] Overall, e-learning in medical education is an exciting and dynamic field that requires creativity and the ability to adapt to the specific and changing contexts in which it is used [5].

Ahmedy et al. (2021) also stated in their study that designing e-learning in medical education requires planning at national and international levels. It was also emphasized that for the qualitative and quantitative improvement of e-learning, global progress, achievements, and standards should be continuously monitored, and strategic, tactical, and executive aspects should be meticulously addressed. They identified e-learning in medical education as an area requiring further research [27].

Shabila et al. (2021) conducted a study to explore medical students' perspectives on the implementation of e-learning in medical education during the Covid-19 pandemic. This study explores medical students' perspectives on e-learning in medical education and emphasizes the need for facilities and training to strengthen the role of e-learning [28].

Alsaywid et al. (2021), study discusses the strategies implemented during global infectious disease outbreaks in their research in Saudi Arabia and emphasizes the support given to medical education through e-learning [29].

In their study, Noerholk and Tolsgaard (2022) discuss the need to transition from individual approaches to collaborative learning strategies in medical education, emphasizing the potential of peer-assisted learning. The increasing use of e-learning in medical education provides insight into medical students' perspectives, the need for the necessary facilities and training, and the potential for collaborative learning strategies. It supports the claim that there is a growing interest in e-learning and its importance in medical education [30]. The results are generally in line with the literature.

In the future, in addition to theoretical applications, medical education programs including many basic professional skills, skills applications, virtual reality, augmented virtual reality, artificial intelligence applications, and online applications to improve clinical skills have also been developed in order to prevent physicians from being deprived of many skills that they cannot do in practice. Creating such experiences can be vital due to the low level of authentic experiences. Of course, research on each of these will be necessary, as in this study.

## 5 Conclusion

This study is one of the first empirical studies to reveal the level of adoption of e-learning applications by family physicians according to demographic factors (gender, working time, age, e-learning experience). According to these results, in addition to the technological infrastructure of e-learning platforms in the field of health, the quality of course content and learning platforms and whether the learning environments have new roles and competencies that they impose on physicians are thought to be important in terms of the quality of the learning experience. Undoubtedly, it should be considered that e-learning in health has difficulties and opportunities. Nevertheless, considering that technology and the internet occupy more and more space in our lives day by day, epidemics and disasters such as Covid-19 pandemic becoming more frequent, and there is a tendency towards a user-centered active education from an educator-centered education in education e-learning applications should be made widespread in our country, as in the world, by eliminating the deficiencies as an application that supports education in all branches in medical education, although not yet in all branches. In this sense, it is thought that in future studies, it will be helpful to research the students of the Faculty of Medicine who experienced the e-learning system in health during the Covid-19 pandemic process and will be active users in the future by including different dimensions with mixed methods. In conclusion, e-learning in medical education is an exciting and dynamic field. The pandemic has further emphasized the importance of e-learning and revealed the importance of distance education in medical education. E-learning has been an essential tool for students to continue their education, and it will continue to play an essential role in medical education with the further expansion and widespread use of technological opportunities. In the future, e-learning in health; With the increasing use of artificial intelligence and machine learning; It is predicted that it will spread to an even wider area with topics such as virtual patients and personalized learning experiences. Finally, to increase the rate of physicians' use of e-learning systems, it would be beneficial to evaluate the data obtained from such studies effectively and continue such studies in depth.

## 6 Declarations

### 6.1 Study Limitations

This study is limited to family physicians who received training from AHUZEM in Turkey and accepted to participate in the study by online survey method and cannot be generalized to all branch physicians.

### 6.2 Acknowledgements

I would like to thank the Ministry of Health, Public Health Institution, Department of Family Medicine Training and Development and the Family Medicine Associations for this research.

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### 6.3 Funding source

No financial support was received for this research.

### 6.4 Competing Interest

There is no conflict of interest in this study.

### 6.5 Authors' Contributions

**Corresponding Author Tarık SEMİZ:** Creation of research idea, research design, literature review, collection of research data, analysis and interpretation of data, article writing.

**Gültekin YILDIZ:** Research design, formulation of research questions. Analysis and interpretation of data.

## 7 Human and Animal Related Study

### 7.1 Ethical Approval

Republic of Turkey Ministry of Health, Public of the Health Institution Directorate of Family Medicine Training and Development Department 14.02.2013 Number: 67350377

### 7.2 Informed Consent

Informed consent form was obtained from all participants for the study that they agreed to participate in the study.

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# Mobile Serious Game on Nursing Students' Knowledge, Motivation, Satisfaction, and Views: Tracheostomy Care Example

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## ABSTRACT

This study is a pre-posttest without control group intervention research conducted to determine the effect of mobile game application for tracheostomy care on the knowledge, motivation and satisfaction of nursing students. The research was carried out between May and June, 2019. The universe of the research consisted of fourth-year students in the Nursing Department, and the sample consisted of 24 students who had to practice tracheostomy care on the patient. Data were collected with descriptive features form, tracheostomy care knowledge test, mobile learning scale, motivation scale related to teaching material, application evaluation and satisfaction form prepared by the researchers. Permission from the ethics committee and institution, and consent from students was obtained. A mobile game of approximately 10 minutes and six stages prepared by the researchers was loaded onto the mobile phones of the students who filled out the descriptive features form and tracheostomy care knowledge test (pre-test), and they were given four weeks to play. At the end of the period, the students completed the knowledge test (post-test), mobile learning scale, motivation scale about teaching material, application evaluation and satisfaction form. Average measurements and the Wilcoxon test were used to evaluate the data. A statistically significant difference was determined between the pre- and post-knowledge test scores of students playing mobile games ($p < 0.001$). It was determined that the average score of the students from the mobile learning scale was 169.04±18.19 (maximum: 190) and the average score they got from the motivation scale related to the teaching material was 134.12±15.31 (maximum: 165). It was determined that the satisfaction averages of the students in remembering the game and care were 7.66±1.71 (0-10). Mobile educational games allow students to repeat their knowledge whenever and wherever they want. Therefore, it is recommended to develop and implement similar applications.

**Keywords:** Mobile Serious Game, nursing students, knowledge, motivation, satisfaction, tracheostomy care.

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# Mobil Ciddi Oyun Uygulamasının Hemşirelik Öğrencilerinin Bilgi, Motivasyon ve Memnuniyetlerine Etkisi: Trakeostomi Bakımı Örneği

## ÖZ

Bu çalışma, trakeostomi bakımına yönelik mobil oyun uygulamasının hemşirelik öğrencilerinin bilgi, motivasyon ve memnuniyetlerine etkisinin belirlenmesi amacıyla yapılmış, kontrol grupsuz ön-son testli müdahale araştırmasıdır. Araştırma Mayıs-Haziran 2019 tarihleri arasında yapılmıştır. Araştırmanın evrenini, hemşirelik bölümü dördüncü sınıfta okuyan öğrenciler, örneklemini ise trakeostomi bakımını hasta üzerinde uygulayan 24 öğrenci oluşturmuştur. Veriler, araştırmacılar tarafından hazırlanan tanımlayıcı özellikler formu, trakeostomi bakımı bilgi testi, Mobil Öğrenme Ölçeği, Öğretim Materyaline Ilişkin Motivasyon Ölçeği, uygulama değerlendirme ve memnuniyet formu ile toplanmıştır. Etik kurul ve kurumdan izin, öğrencilerden onam alınmıştır. Tanımlayıcı özellikler formu ve trakeostomi bakımı bilgi testini (ön-test) dolduran öğrencilerin cep telefonlarına araştırmacılar tarafından hazırlanmış yaklaşık 10 dakikalık ve altı aşamadan oluşan trakeostomi bakımı mobil oyunu yüklenmiş ve oynamaları için dört haftalık bir süre verilmiştir. Süre sonunda öğrenciler bilgi testi (son-test), mobil öğrenme ölçeği, öğretim materyaline ilişkin motivasyon ölçeği, uygulama değerlendirme ve memnuniyet formunu doldurmuşlardır. Verilerin değerlendirilmesinde ortalama ölçüleri ve Wilcoxon testi kullanılmıştır. Mobil oyunu oynayan öğrencilerin ön ve son bilgi test puanları arasında istatistiksel açıdan anlamlı fark belirlenmiştir ($p < 0.001$). Öğrencilerin Mobil Öğrenme Ölçeğinden aldıkları puan ortalamasının 169,04±18,19 (maksimum:190) olduğu ve Öğretim Materyaline Ilişkin Motivasyon Ölçeğinden aldıkları puan ortalamasının 134,12±15,31 (maksimum:165) olduğu belirlenmiştir. Öğrencilerin, oyun ile bakımı hatırlama konusundaki memnuniyet ortalamalarının 7,66±1,71 (0-10) olduğu belirlenmiştir. Mobil öğretici oyunlar, öğrencilerin istedikleri yer ve zamanda bilgilerini tekrar etmelerini sağlamaktadır. Bu nedenle benzer uygulamaların geliştirilmesi ve uygulanması önerilmektedir.

**Anahtar kelimeler:** Mobil ciddi oyun, hemşirelik öğrencileri, bilgi, motivasyon, memnuniyet, trakeostomi bakımı

## 1 Introduction

The teaching methods and techniques commonly used in nursing education include question and answer, discussion, problem-solving, demonstration, role-playing, observation, case study, learning by doing and living, group studies, and educational games [1,2]. Educational games, simulation, and mobile learning are among the modern education methods that have been used in nursing education with developing technology. Z generation nursing students are used to technology and require the integration of technology into education [3]. Z generation students prefer acting individually, learning with games, oriented teaching methods instead of traditional narratives, learning when they want, storytelling rather than memorization, a creativity and innovation [4]. For this purpose, games that increase students' motivation have been used in nursing education in recent studies. These games used for educational purposes are called serious games.

Serious games are a new classification used for games in health education [5]. Studies have shown that serious games increase students' motivation and improve their knowledge and skills [1,6]. Games are a teaching technique that allows the information to be repeated and reinforced in a comfortable environment. Particularly, games ensure that abstract concepts are materialized, and the information learned is retained. Serious games are activities that are prepared according to the characteristics of the subject, have certain rules, and in which students participate voluntarily or individually or as a group based on competition [7]. These kinds of applications are one of the simulation methods aimed at education by using the understanding of entertainment and interaction as a tool. The games are prepared in a virtual environment according to the information targeted to be taught and allow the users to realize

the real-life situations such as analysis, decision-making, and planning [8,9]. These applications are also suitable for the learning styles of new-generation students who have been actively learning with and shaped by technology and have made technology a part of their daily lives [10].

Serious games can be implemented on a computer, tablet, or mobile device. In the literature, it was determined that bed making, aseptic technique, vital signs measurement and oxygen therapy skills [11], drug dose calculations [12], hypertension and diabetes information [2], basic life support [13], cardiopulmonary resuscitation procedure [14], oral care [15], intravenous catheterization [16], neonatal resuscitation [17], and urinary catheterization [18] were taught using a computer, tablet or mobile phone. In particular applications on mobile phones enable students to easily and quickly use them without risking patient safety, as well as to learn whenever and wherever they want [9]. In addition, games give students the opportunity to develop their skills in a virtual environment via mobile without entering the laboratory environment. This provides convenience to students in teaching applications such as tracheostomy care, which is a complex skill that is difficult for students to learn [19]. The games are provided to learn by seeing the results of their mistakes through giving feedback to the students and by living [20]. In addition, because mobile games support distance education, they will be useful and become widespread in nursing education in today's COVID-19 pandemic process.

Studies indicate that mobile games are effective in learning, facilitate learning, enable the transfer of theoretical knowledge into practice, and improve students' knowledge, skill, motivation, self-confidence, self-efficacy and critical thinking skills [1,9,18,19]. Tracheostomy care requires fulfill the checklist in the right order. Because it is important for patient safety that students perform operations in accordance with aseptic skills. Mobile game developed for tracheostomy care allow students to repeat lessons on their mobile phones. For this reason, the aim of this research was to determine the effect of a mobile serious game developed for tracheostomy care on the knowledge levels, motivation, and satisfaction of nursing students, if the teaching method was effective and students' views on the application.

## 2 Methodology

This study a pre-posttest design without control group intervention. The study population comprised 30 of the 200 previous year's senior (mean: 21.96 ± 0.65) students in the spring semester of the 2018–2019 academic year in the Nursing Department, at a university in Turkey. The study was conducted between May-June, 2019. 30 students who performed tracheostomy aspiration and care on the patient in clinical practice, met the inclusion criteria and agreed to participate in the study were included in the study. However, 6 students, who did not complete the posttest and evaluation form, were excluded from the study, and the study was terminated with 24 students.

*The inclusion criteria:*

- Participants had to have performed or monitored tracheostomy care in clinical practice.
- Participants had to have an Android mobile phone.
- Participants had to have internet access.
- Participants had to be 18 years or older
- Participants had to be last class students

*The exclusion criteria:*

- Participants who did not the last test and complete the assessment form.
- Students who do not play the mobile game
- Students who have not completed the six stages of the mobile game

The power analysis was carried out using G*Power 3.1. according to the results of the study it was determined 86% power and a significance level of 0.05, was at least 24 students with an effect size 0.50.

### 2.1 Ethical Approval

Written approvals for this study were obtained from the university ethics board (Date: 28/03/2019, No: 63582098/299) and from the Department of Nursing where the study was performed. Students with informed consent were included in the study.

### 2.2 Data Collection and Instruments

The data were collected using the 'Descriptive Characteristics Questionnaire', 'Tracheostomy Care Information Test', 'Mobile Learning Scale', 'Motivation Scale for Teaching Material', and 'Application Evaluation and Self-Evaluation, and View Form'.

The 'Descriptive Characteristics Questionnaire' has 8 questions in total; this part was filled out by the students.

The "Tracheostomy Care Knowledge Test" was created by Bayram and Caliskan 2019 [19]. This test comprises 23, 5-option multiple-choice questions for tracheostomy care. The content of the question consists of the information given in the steps of suctioning, tracheostomy cannula and stoma cleaning. Correct answers in the test are evaluated as 1 point and incorrect answers as 0 points. The lowest possible score on this test is 0, and the highest is 23 points.

The "Mobile Learning Scale" was created by Demir and Akpinar in 2016 [21]. The scale consists of 45 items and 4 factors satisfaction factor (20), learning effect factor (11), motivation factor (7), and usefulness factor (7). The created items are 5-point Likert type items: I completely agree (5), agree (4), partially agree (3), disagree (2) and completely disagree (1) (min: 45-max: 225). The Cronbach α internal consistency coefficient was examined, and it was concluded to reach 0.95. In our study, Cronbach α value was found to be 0.91.

The "Motivation Scale for Teaching Material" was created by Keller in 2010. The scale adapted into Turkish by Dincer and Doganay in 2016 [23]. The scale is scored as very correct (5), correct (4), moderately correct (3), slightly correct (2), or not correct (1), and consists of 33 items in total (min: 33-max: 165). The Cronbach α internal consistency coefficient was examined, and it was concluded to reach 0.97. In our study, Cronbach α value was found to be 0.63.

The "Application Evaluation, Self-Evaluation and View Form" was created by the researchers according to the literature [2,8]. This form consists of 3 parts. The first part consists of 16 questions 5 rated on Likert-type scale ranging from very correct (5), correct (4), moderately correct (3), slightly correct (2), and not correct (1) regarding opinions on the mobile serious game application. The highest score that students can get in this part is 80. In the study, the average of each Item and the total score was taken.

The second part consists of 3 that self-evaluation questions (sufficient, partially sufficient and insufficient). The students evaluated themselves according to the 3 stages of the tracheostomy care procedure and responded to their repetition and recall status in the clinic. In the views Open-ended questions were asked to the students, including their positive and negative views about the tracheostomy care game application. These questions are as follows:

- What do you think is the positive side of the tracheostomy care game?
- What do you think is the negative side of the tracheostomy care game?

### 2.3 Mobile Serious Game Developed for Tracheostomy Care

A mobile serious game was developed for tracheostomy by authors (http://trakeostomibakimi.com/). The researchers prepared a mobile serious game scenario that included pictures, according to the tracheostomy care content. The mobile serious game for tracheostomy care was designed using Adobe Flash Professional CC and Adobe Flash CS6. Authors were conducted study on first grade students and determined that the game increased their knowledge and skill levels [19]. In the game, students must ensure the character of Nurse Demet performs tracheostomy care on a patient, Mrs. Melek, and record the results, following the procedural steps through three stages (Figure 1). An automatic e-mail was sent to the researcher when the students played the game. There was no management panel about the game and no information about the stage at which the students left the game. The researcher could only see the students who completed the six stages of the game.

**Figure 1:** *Mobile serious game screenshot*

### 2.4 Intervention

The study was conducted between May and June 2019. First the "Tracheostomy Care Knowledge Test" was applied to the students determined according to the sample selection criteria. Then, the mobile serious game care was loaded by a researcher on to the students' mobile phones and a duration of 4 weeks was given to each student to play. Students have played the game at least once, and a maximum of 10 times. At the end of the duration, the students received a knowledge test again. Finally, the students filled out the "Tracheostomy Care Information Test", "Mobile Learning Scale", "Motivation Scale for Teaching Material", and "Application Evaluation, Self-Evaluation and View Form", respectively.

### 2.5 Data analysis

The data obtained from the study were analyzed using the IBM SPSS statistics 23.00 for windows. Number (n), percentage (%), mean, median, and standard deviation (SD) values were used in descriptive statistical evaluation of the data. A one-sample Kolmogorov Smirnov test was used to evaluate data with normal or non-normal distribution. The Wilcoxon test was used for the matched groups to determine the differences between the pre and posttest scores. The data were evaluated at a confidence interval of 95% and at a $p < 0.05$ significance level.

## 3 Results and Discussion

The results of study explained that 79.2% of participants were women, 66.7% had graduated from high school, and 83.3% chose the nursing profession willingly because not all students in Turkey always get their first choice. Of the participants, 75% use digital tools while studying, the most preferred of which is the mobile phone (62.5%), educational mobile phone or computer (62.5%) and it was determined that 58.3% of them performed hands-on tracheostomy care in clinical practice. The remaining had the opportunity to monitor tracheostomy care but no hands on practice. A statistically significant difference was observed between the pre and posttest knowledge scores ($p < 0.05$) (Table 1).

**Table 1:** *Comparison of pre and post-test knowledge scores*

| Knowledge test score | Mean ± SD | Median | Z /p* |
|---|---|---|---|
| Pretest | 11.95 ± 2.94 | 11 (8-21) | -2.699 |
| Posttest | 14.20 ± 3.09 | 13 (9-22) | .007 |

*Wilcoxon test

We determined that the students gave 75 points (min: 20-max: 100) to the satisfaction factor, 43.5 (min: 10-max: 55) to the learning effect factor, 29 (min: 7-max: 35) to the motivation factor and 18.50 (min: 7-max: 35) (to the usability factor on the mobile learning scale. We determined that the total score of the mobile learning scale was 165 (min: 45-max: 225), and these values were above normal with reference to the Mobile Learning Scale by Demir and Akpinar in 2016 [22]. The motivation scale score of the teaching material was 133 (min: 33-max: 165), and this value was above normal with reference to the Motivation Scale for Teaching Material by Dincer and Doganay in 2016 [23]. Students evaluated their satisfaction with game learning as 8 out of 10 (Table 2).

**Table 2:** *Mobile learning scale and motivation scale for teaching material and satisfaction scores*

| Mobile learning scales, and subscales | min-max* | Mean ± SD | Median (min-max) |
|---|---|---|---|
| Satisfaction factor | 20-100 | 76.83 ± 11.49 | 75 (54-100) |
| Impact factor on learning | 10-55 | 45.37 ± 5.71 | 43.50 (34-55) |
| Motivation factor | 7-35 | 28.45 ± 5.86 | 29 (7-35) |
| Usability factor | 7-35 | 18.37 ± 6.95 | 18.50 (8-35) |
| Total score | 45-225 | 134.12 ± 15.31 | 165 (136-210) |
| **Motivation scale for teaching material** | 33-165 | 134.12 ± 15.31 | 133 (100-161) |
| **Satisfaction score** | 0-10 | 7.66 ± 1.71 | 8 (3-10) |

*indicates that learning and motivation increase as the average score approaches towards the maximum value.

In Table 3, student opinions about mobile games are given. When students' opinions about the game are taken I students gave highest 4.66 ± 0.73 points to "I was able to complete the tracheostomy care" (max:

5). The students gave only lowest 1.28 ± 0.64 points to "I found it very unnecessary and complicated". We determined that the total score given by the students to the mobile serious game application was 58 out of 80 (Table 3).

**Table 3:** *Distribution of the means of the students' views for mobile game*

| The students' views | Mean ± SD | Median (min-max) |
|---|---|---|
| 1. It was easy to use. | 3.47 ± 1.03 | 4 (1-5) |
| 2. The text information on the screen was clear. | 3.95 ± 1.02 | 4 (1-5) |
| 3. The information on the screen was easy to read. | 4.61 ± 0.58 | 5 (3-5) |
| 4. I understood what to do at every stage. | 3.23 ± 1.13 | 3 (1-5) |
| 5. I had no technical problems in use. | 2.28 ± 1.23 | 2 (1-5) |
| 6. The visual quality was good. | 4.33 ± 0.91 | 5 (2-5) |
| 7. It was fun to use. | 3.90 ± 1.22 | 4 (2-5) |
| 8. Speed was enough. | 2.28 ± 1.38 | 2 (1-3) |
| 9. It provides the student's preparation for the clinic. | 4.33 ± 0.79 | 4 (2-5) |
| 10. I would like to use it frequently. | 3.90 ± 0,99 | 4 (2-5) |
| 11. I found it very unnecessary and complicated. | 1.28 ± 0.64 | 1 (1-3) |
| 12. It could be used technically without the support of someone. | 4.00 ± 1.14 | 4 (1-5) |
| 13. The environment was visually realistic. | 4.19 ± 1.16 | 5 (1-5) |
| 14. I was able to carry out the tracheostomy care procedure steps. | 4.47 ± 0.81 | 5 (2-5) |
| 15. I was able to complete the tracheostomy care. | 4.66 ± 0.73 | 5 (2-5) |
| 16. The referrals were enough. | 3.23 ± 1.33 | 3 (1-5) |
| Total score | 58.19 ± 9.68 | 58 (28-73) |

In Table 4, students' self-evaluation scores regarding tracheostomy care are given. The students evaluated themselves according to the 3 stages of the tracheostomy care procedure (sufficient, partially sufficient and insufficient). The students stated that 42.9% had sufficient knowledge for peristomal skin care, 47.6% had partially sufficient knowledge for suctioning a tracheostomy tube, and 23.8% for tracheostomy internal cannula cleaning (Table 4).

**Table 4:** *The students' self-evaluation on tracheostomy care*

| Skills | Sufficient | | Partially sufficient | | Insufficient | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Suctioning a tracheostomy tube | 5 | 23.8 | 10 | 47.6 | 1 | 4.2 |
| Inner cannula cleaning | 3 | 14.3 | 5 | 23.8 | 4 | 19.0 |
| Peristomal skin care | 9 | 42.9 | 4 | 19.0 | 2 | 9.5 |

### 3.1 Student's interviews

In the answers given by the students to the open-ended questions including positive and negative thoughts about the mobile serious game application; all the students stated that their friends would be satisfied with the mobile learning environment. A student described his satisfaction as follows: "… I think not everyone can be involved in tracheostomy care in clinics, this and similar applications will be beneficial for everyone in learning stages such as knowing someone by sight and procedure steps" (form number 4). The students stated that the game enabled learning while being entertaining. One student

said "Although the information given when playing a game was a lesson, the experience was more like a game than a lesson. In this way, I think it provides catchy" (form number 11). The students stated that the game contributed to learning more and that it was not sufficient to improve their skills, and one student stated "The game was facilitated learning. It did not contribute to my skill as I could not apply on patient" (form number 20). The students stated that such games should be used in education, and one student wrote, "I believe that it will make a difference in training nurses when it is developed, and it should definitely be used" (form number 11). One of the students explained how he felt when he played the game as follows: "I felt like a real hospital environment. I tried to carefully do the tracheostomy care" (form number 20).

Most of the students stated also that the games were funny and motivating, increased their knowledge and skills, and provided knowledge was retained. On the negative side, the students stated that the game slowed down occasionally, and the tips and directions were not sufficient.

As an active learning method, serious games perform an important role in teaching and transferring knowledge to practice. For this reason, they are frequently used in nursing education studies today [8]. Similar to the results of the literature [2,11,14,24] it was determined that the knowledge levels of the students using the game for tracheostomy care increased significantly.

The information learned in the studies is knowledge level, feedback is received after a wrong application in the virtual environment, and the student learns by seeing the errors in the application [2,11,14,18]. Similarly, in our study, students stated that when they make mistakes, they learn by correcting their mistakes without harming anyone and that the information they learn is knowledge level. The results in the study of Savran and Efe. showed that that the serious game simulation application used in neonatal resuscitation training was effective in raising the students' ventilation and compression performing skills [17]. Ordu and Çalışkan state that virtual gaming simulation increases the mean scores of nursing diagnosis and goal-setting knowledge of the students. Most of the students stated positive statements related to virtual gaming simulations [3]. Min et al., stated that serious games in nurse education to enhance students' knowledge and performance [6]. Kardong-Edgren et al. stated that the 75% of students indicated that the game improved their skills and that they could perform the operation in a short time, they learned the skill by getting feedback when they made a mistake, and then they placed the catheter correctly [18]. In the didactical techniques, nursing students acquire knowledge about patient care, diseases, medications, and treatments [25]. Mobile apps can be used for nursing education purposes to support the educator and provide learning activities [26]. A recent systematic review showed that although game-based education interventions can enhance nursing students' learning experiences, further research should focus on examining the use of specific games in nursing students [27].

For students to gain proficiency by transforming knowledge into skills, game applications also protect patient safety and provide the convenience to practice many times in a virtual environment [20]. In our study, the students were able to play the game as much as they wanted within a month, and they stated that the game was effective in learning ($p=0.007$) (Table 1). The students had sufficient knowledge for peristomal skin care, and partially sufficient knowledge for suctioning a tracheostomy tube and internal cannula cleaning. In some studies, it has been stated that teaching with games increases students' self-efficacy status [12]. In addition to students' seeing themselves as sufficient, it has been stated in the literature that students develop problem-solving skills in the care-giving process [1]. In the study conducted by Kim & Park stated that smartphone-based mobile learning had significantly positive influence on nursing students' knowledge, skills, confidence in performance, and learning attitude [12]. Similarly, in our study, the effect and usefulness score on learning, which is a sub-dimension of the

mobile learning scale, was found to be above normal (133) (Table 2). Motivation is important for students to focus their attention on the subject before learning. Motivating students on the subject before teaching skills, especially in nursing education, which is an applied department, increases learning [1,28]. In our study, similar to the literature, it was determined that students' score for the motivation factor and motivation scale was above normal. İdrissi et al. reported that motivation of students who serious game on the learning of nursing care in pediatrics effected [29]. Kang and Suh stated that the application was useful to students [2], they could follow the patient and learn while having fun. Kardong-Edgren et al. stated that most students wanted to use the game frequently and that the system was easy to use [18].

In this study, the students stated their satisfaction score about mobile learning as high points. Abou Shosha et al. stated that post graduate nursing students' post satisfaction scores are higher than the pre one after using mobile based. Epstein and Bertram found that students in their study ensured that mobile learning helped them to reflect and relate to self, others and their environments which increase their satisfaction level [30]. In our study, all students found the game enjoyable, were able to prepare for the clinic, and were satisfied with the game (Table 3). Kardong-Edgren et al. indicated that most students stated that the game was funny and suitable for their own learning method [18].

In this study, almost half of the students stated that they found themselves sufficient in peristomal skin care and partially sufficient in other applications (Table 4). The use of digital teaching techniques that remind students of knowledge and skills during the application provides them with self-confidence. Students can increase their knowledge level by playing games in a virtual laboratory environment while learning a subject outside the classroom.

## 4 Conclusions

The tracheostomy game increased students' satisfaction and motivation in nursing education and improves their knowledge and skills. Nursing students transfer the knowledge to practice, gain competence and trust in themselves, and are ready for clinical practice. For this reason, the use of technological methods is becoming widespread for students to repeat processes again whenever and wherever they want. As technological methods are an indispensable source of information for new generation students, they increase students' motivation and satisfaction and ensure their active participation in the course. As we can see from the results of this study, it is recommended to increase the number of studies using active teaching methods and to use different methods such as mobile learning in nursing education.

## 5 Declarations

### 5.1 Study Limitations

The study was conducted as a pilot study in a single center and only with students who underwent or monitored tracheostomy. Therefore, the sample of our study was small. This would be a good place to recommend future studies. A larger study is needed in different settings. In addition, the study was not planned as a control group intervention study.

### 5.2 Acknowledgements

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### 5.4 Competing Interests

There is no conflict of interest in this study.

### 5.5 Authors' Contributions

**Corresponding Author Şule BIYIK BAYRAM:** Developing ideas or hypotheses for the research and/or article, planning the materials and methods to reach the results, taking responsibility for the experiments, organizing and reporting the data, taking responsibility for the explanation and presentation of the results, taking responsibility for the literature review during the research, taking responsibility for the creation of the entire manuscript or the main part, reworking not only in terms of spelling and grammar but also intellectual content.

**Nurcan ÇALIŞKAN:** Developing ideas or hypotheses for the research and/or article, planning the materials and methods to reach the results, reworking not only in terms of spelling and grammar but also intellectual content or other contributions.

## 6 Human and Animal Related Study

### 6.1 Ethical Approval

Written approvals for this study were obtained from the university ethics board (Date: 28/03/2019, No: 63582098/299) and from the University Department of Nursing where the study was performed.

### 6.2 Informed Consent

Informed consent form was obtained from all participants for the study that they agreed to participate in the study.

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# Effects of TENS and Physiotherapy on Chronic Constipation in Myelomeningocele

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## ABSTRACT

Chronic constipation is a common symptom of Myelomeningoceles. TENS has been proven to be effective in treating constipation in different populations and parameters. Physiotherapy is a relatively recent treatment for constipation and has not been extensively studied in pediatrics and Spina Bifida. This study aimed to examine the role of TENS in Myelomeningocele and to increase the number of studies on physiotherapy for pediatric constipation. This study also aimed to determine a new treatment approach that can be applied to chronic constipation in children with Spina Bifida using physical therapy. Constipation symptoms, stool pattern, bladder and bowel dysfunction, muscle strength involved in defecation, pressure pain thresholds (ppt) in these muscles, severity of fecal incontinence, and quality of life were assessed prior to treatment. Physical Therapy (PT) group received manual physical therapy techniques and dietary therapy for six weeks while the Physical Therapy and TENS (PT+T) group also received TENS. The post-treatment evaluations were repeated. A total of 28 children, 14 in each group, were included in the study. The stool form in both groups of children was constipated. There was a significant difference in stool pattern only PT+T group ($p<0.05$). Myofascial trigger points (MTrPs) were significantly reduced in both groups ($p<0.05$). Ppt and muscle strength increased significantly in PT group ($p<0.05$). Severity of fecal incontinence, constipation symptoms, and bladder-bowel dysfunction decreased significantly in both groups, but satisfaction with treatment increased ($p<0.05$). PT group had a statistically significant improvement in quality of life ($p<0.05$). TENS and physical therapy are safe and effective approaches that can be executed in clinical practice to reduce the symptoms of chronic constipation in myelomeningoceles.

**Keywords:** Myelomeningocele, Spina Bifida, Constipation, TENS, Physiotherapy

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# Miyelomeningosellerde TENS ve Fizyoterapinin Kronik Konstipasyon Üzerine Etkisi

## ÖZ

Kronik konstipasyon, Miyelomeningosellerde sık görülen bir semptomdur. TENS'in farklı popülasyonlarda ve parametrelerde konstipasyonun tedavisinde etkili olduğu kanıtlanmıştır. Fizyoterapi konstipasyon için nispeten yeni bir tedavi yöntemidir ve pediatrik olgular ile Spina Bifida'da kapsamlı bir şekilde araştırılmamıştır. Bu çalışmada Miyelomeningosellerde TENS'in rolünün incelenmesi ve pediatrik olgularda konstipasyona dair fizyoterapi araştırmalarının sayısının arttırılması amaçlandı. Çalışmada ayrıca Spina Bifida'lı çocuklarda kronik konstipasyon için fizyoterapi uygulanarak yeni bir tedavi yaklaşımının belirlenmesi amaçlandı. Tedavi öncesi konstipasyon semptomları, dışkı formu, mesane ve bağırsak disfonksiyonu, dışkılamayla ilgili kas kuvveti, bu kaslardaki basınç-ağrı eşikleri (ppt), fekal inkontinansın şiddeti ve yaşam kalitesi değerlendirildi. Fizyoterapi (PT) grubuna altı hafta boyunca manuel fizyoterapi teknikleri ve diyet tedavisi uygulanırken, Fizyoterapi ve TENS (PT+T) grubuna ayrıca TENS uygulandı. Değerlendirmeler tedavi sonrasında tekrarlandı. Çalışmaya her grupta 14 olmak üzere toplam 28 çocuk dahil edildi. Her iki gruptaki çocukların dışkı formu konstipeydi. Sadece PT+T grubunda dışkı formu açısından anlamlı fark vardı ($p<0.05$). Miyofasiyal tetik noktalar (MTrPs) her iki grupta da anlamlı derecede azaldı ($p<0.05$). Ppt ve kas kuvveti PT grubunda anlamlı derecede arttı ($p<0.05$). Her iki grupta da fekal inkontinansın şiddeti, konstipasyon semptomları ve mesane-bağırsak disfonksiyonu anlamlı derecede azaldı, tedaviden memnuniyet arttı ($p<0.05$). PT grubunda yaşam kalitesinde istatistiksel olarak anlamlı iyileşme görüldü ($p<0.05$). TENS ve fizyoterapi, Miyelomeningosellerde kronik konstipasyon semptomlarını azaltmak için klinik pratikte uygulanabilecek güvenli ve etkili yaklaşımlardır.

**Anahtar Kelimeler:** Miyelomeningosel, Spina Bifida, Konstipasyon, TENS, Fizyoterapi

## 1 Introduction

Myelomeningocele or Spina Bifida (SB) is a neural tube defect that occurs on the 28th day of gestation. Due to weak innervation and slow defecation in these patients, feces stay in the bowel longer and the bowel cannot be completely emptied. In addition, medications, decreased muscle tone, and bladder problems can cause constipation [1].

Pelvic organs are connected to the pelvic wall by the pelvic fascia. The connections between the neural pathways of the pelvic organs form the working rhythms of the bladder and bowel. Dysfunction in any of these organs can lead to an effect in children with myelomeningocele that affects the sacral plexus [2]. Furthermore, myofascial trigger points (MTrPs) in the muscles that connects the deep frontal fascial line and the core and gluteal muscles, indirectly affect pelvic floor muscle function, leading to spasm and constipation [3]. Especially in children with SB, who have limited mobility and are seated in a wheelchair for a long time, MTrPs occur mainly due to muscle shortening in the abdominal and groin areas.

Pelvic floor rehabilitation aims to fully coordinate defecation with isometric contractions of the abdominal wall and eccentric contractions of the pelvic floor, resulting in the correct synergy of abdominal and pelvic relaxation [4]. The goal of patients with SB is to increase colonic passage without significantly altering stool consistency. In clinical practice, attempts have been made to overcome this problem with appropriate laxatives [5], but loose stools increase the risk of fecal incontinence. In addition, it can cause symptoms such as chronic constipation, bloating, abdominal pain, and irritability, which can affect the quality of life [6]. In our study, we examined the effect of physical therapy

techniques and TENS on constipation in myelomeningocele patients, which has valid results in different groups in the literature [7, 8].

Transcutaneous Electrical Nerve Stimulation (TENS) is one of the most preferred methods of electrical stimulation. TENS works by using electrical currents to activate neural structures in the central nervous system [9].

Electrical stimulation was first reported by Balcom et al. in myelomeningocele in 1997. It began to be used by families during night-time sleep. The effect of a current with a frequency of 55 Hz and pulse width of 280 μs on the bladder was studied in the abdominal and buttock regions. The study showed that, patients were able to better predict their bowel movements and develop a better sense of pelvic fullness [10].

Sacral nerve stimulation was attempted in children with slow transit constipation in a follow-up conducted in 2006. TENS was used to conduct sacral nerve stimulation at a frequency of 140 Hz and width of 300-400 microseconds, which is effective for severe constipation [7].

In clinical practice, we observed that strengthening the abdominal muscles is effective in emptying myelomeningoceles with weak pelvic floor muscles. Furthermore, it has been shown that physical therapy methods applied on MTrPs, such as ischemic compression, myofascial release, and posterior relaxation techniques, can adversely affect the effective function of these muscles, thereby reducing MTrPs activation [11].

This study aimed to elucidate the role of TENS and physical therapy, which have been reported to have beneficial effects in different populations of children with neurogenic bladder and bowel disorders. Although the children in our study had bladder and bowel problems, the purpose of our study was to discuss the effects of TENS and physical therapy approaches on constipation, constipation symptoms, stool patterns, MTrPs, pressure pain thresholds (ppt), muscle strength and quality of life in children with myelomeningocele who have chronic constipation problems.

## 2 Methodology

### 2.1 Study design

Twenty-eight children with myelomeningocele and chronic constipation aged 5-15 years were randomized into two groups of 14-14 after obtaining parental consent. In the “physical therapy” group (PT group) children received manual abdominal massage, trigger point release, breathing exercises, rib mobilization, sensory stimulation of the gluteus maximus and rectus abdominis and strengthening exercises in the 'core' area muscles for 6 weeks, 3 days a week. Awareness of the pelvic floor muscles, which may be a sensory defect in the majority of myelomeningoceles, was increased by diaphragmatic breathing and normal voiding and defecation patterns were taught. Diaphragmatic breathing exercises were performed by explaining to the patients that they should breathe deeply through their nose and direct their breath towards the diaphragm, contracting the pelvic floor eccentrically and pushing their anus down. While doing this, the patient was not allowed to hold their breath or actuate the valsalva mechanism. In addition, in the first session, individual diet therapy was provided by a specialist dietitian, considering the patient's eating habits, anthropometric measurements and comparing the percentile curve that should be based on their age.

In addition, TENS received to “TENS and physical therapy” group (PT+T group) for 6 weeks with a frequency of 10 Hz and a current width of 400 ms for 20 min [9].

The study included children with SB who had suffering from chronic constipation and had regular urodynamic clinical follow-ups until our treatment. The International Continence Society (ICS) defines constipation as a complaint that bowel motions are infrequent and/or incomplete and/or there is a need for frequent straining or manual assistance to defecate (Rome IV criteria) [12]. Children with mentally retardation who had undergone pelvic surgery and those with active infection at study entry were excluded. The ethics committee for this study was approved by the Clinical Research Ethics Committee of the Marmara University Faculty of Medicine (protocol number 09.2020.07).

### 2.2 Outcome measures

The stool pattern classification of the 28 children with SB included in the study was determined using the Bristol Stool Scale (BSS). The Bristol Stool Scale is a simple and understandable scoring method for subjective evidence of constipation. In this stool type score explained with pictures to parents or caregivers caring for patients, it can be seen that the stool types of constipation, such as type 1 and type 2. Types 3 and 4 refer to the normal type of poop, and types 5, 6 and 7 refer to the liquid stool types. The Patient Assessment of Symptoms of Constipation (PAC-SYM) questionnaire was used to assess symptoms due to constipation, and the Patient Assessment of Constipation and Quality of Life Scale (PAC-QOL) was used to determine the impact of chronic constipation on the quality of life, severity of constipation symptoms over the past 2 weeks, their impact on daily life, mood changes, and how their lives continued. The Children's Bladder and Bowel Dysfunction Questionnaire (CBBDQ) was used to assess bladder and bowel dysfunction in children. In addition, the Fecal Incontinence Severity Index (FISI) was filled in to assess the severity of fecal incontinence possibly caused by constipation. A decrease in the PAC-QOL (first part), CBBDQ, and FISI scores indicates improvement. Besides, manual muscle testing was performed to measure the strength of the exercise-treated muscles and the pain pressure threshold (ppt) of the same muscles was measured using a J-Tech Algometer Commender$^{TM}$ device.

### 2.3 Statistical Analysis

In classifying the data obtained in the study, qualitative and quantitative statistical methods were evaluated with 80% confidence intervals using the SPSS 22 statistical program, and the significance was evaluated at $p<0.05$. Nonparametric tests were used for data that did not follow normal distribution. The significance of before and after data was tested using the Wilcoxon Signed test.

## 3 Results and Discussion

There were no significant differences between the groups in terms of sex, level, wheelchair use, and age (Table 1).

**Table 1:** *Demographic Features*

| | | PT group (n=14) | | PT+T group (n=14) | | Total (n=28) | | *p* value |
|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | |
| Gender | Male | 10 | %71.4 | 8 | %57.1 | 18 | %64.3 | $X^2$=0,62 p=.347[a] |
| | Female | 4 | %28.6 | 6 | %42.9 | 10 | %35.7 | |
| Level | Lumbosakral | 2 | %14.3 | 4 | %28.6 | 6 | %21.4 | $X^2$=1,00 p=.607[a] |
| | Torakolomber | 7 | %50.0 | 5 | %35.7 | 12 | %42.9 | |
| | Lomber | 5 | %35.7 | 5 | %35.7 | 10 | %35.7 | |
| Using wheelchair | Yes | 10 | %71.4 | 7 | %50.0 | 17 | %60.7 | $X^2$=1,34 p=.220[a] |
| | No | 4 | %28.6 | 7 | %50.0 | 11 | %39.3 | |
| Age | | 14 | Mean | 14 | Mean | 28 | | p=.585[b] |
| | | | 7.86±2.03 | | 8.36±2.70 | | | |

*PT* Physical therapy, *PT+T* Physical therapy+TENS
[a] Chi-square test, [b] Indipendent *t* test

The form of stool in both groups of children was constipated according to BSS. Although almost every child achieved a normal stool pattern after treatment, only PT+T group showed a statistically significant change in stool pattern (p=0.02, Table 2). The BSS scores of the patients before and after treatment did not differ significantly between groups (p>0,05, Table 2).

Pre- and post-treatment values for questionnaires and scales asking about stool type, constipation-related symptoms, fecal incontinence, bladder-bowel dysfunction, and constipation-related quality of life are shown for the PT and PT+T groups (Table 2).

**Table 2:** *Outcome Results*

| **Scales** | **PT group** | | | **PT+T group** | | | **Diffence Between Groups[a]** | |
|---|---|---|---|---|---|---|---|---|
| | **Before** | **After** | ***p* value** | **Before** | **After** | ***p* value** | **Before *p* value** | **After *p* value** |
| BSS | 2.71±1,.2 | 3.50±0.65 | .085 | 2.43±1.15 | 3.21±0.80 | **.021** | .612 | .031 |
| FISI | 16.4±8.86 | 12.43±7.61 | **.002** | 30.0±16.48 | 25.50±16.00 | **.007** | **.010** | **.001** |
| PAC-SYM | 7.14±5.48 | 3.57±3.63 | **.010** | 11.29±7.72 | 8.14±7.09 | **.004** | .114 | **.04** |
| CBBDQ | 18.79±9.22 | 15.79±9.21 | **.000** | 26.43±12.17 | 24.00±11.48 | **.001** | .072 | **.047** |
| PAC-QOL (first part) | 7.50±9.64 | 6.43±9.42 | **.015** | 11.93±10.23 | 9.93±8.22 | .056 | .249 | .305 |
| PAC-QOL (satisfy part) | 6.36±3.71 | 10.36±2.43 | **.000** | 6.50±3.08 | 9.93±2.86 | **.000** | .913 | .674 |

*BSS* bristol stool scale, *FISI* fecal incontinence severity index, *PAC-SYM* patient assessment of constipation symptoms questionnaire, *CBBDQ* childhood bladder and bowel dysfunction questionnaire, *PAC-QOL* patient assessment of constipation quality of life questionnaire
Values in bold indicate a significance of p<0.05
[a]Independent groups t-test

Consequently, there was a statistically significant reduction in the severity of fecal incontinence in both groups (p=0.00). Likewise, a reduction in the severity of incontinence resulted in a significant reduction in the symptoms caused by constipation (p=0.01; PT group, p=0.00; PT+T group). Thus, in line with the positive results obtained for constipation and fecal incontinence, bladder-bowel dysfunction assessed using the CBBDQ questionnaire was improved in both groups (p=0.00). Meanwhile, there was a negative correlation between bladder-bowel dysfunction and treatment satisfaction (r=-0.54; p=0.00), while a positive correlation was found between constipation-related symptoms (r=0.47; p=0.01) and fecal incontinence severity (r=0.58; p=0.00). While the PAC-SYM values of the patients before treatment did not differ significantly according to the group (p>0.05), the PAC-SYM values after treatment showed a significant difference between the groups ($t_{(26)}$=2.147; p=0.041<0.05). The PAC-SYM values of PT+T group after treatment ($\bar{x}$=8,140) were higher than PT group ($\bar{x}$=3,570). The FISI values of before and after treatment showed a significant difference between the groups (before treatment $t_{(26)}$=2.770, p=0.010<0,05; after treatment $t_{(26)}$=2.087; p=0.047<0,05). The FISI values of PT+T group before treatment ($\bar{x}$=30,000) were higher than the values of PT group ($\bar{x}$=16,140). The FISI values of PT+T group after treatment ($\bar{x}$=25,500) were higher than the values of PT group ($\bar{x}$=12,430). The CBBDQ values after treatment showed a significant difference between the groups ($t_{(26)}$=2.087; p=0.047<0,05). The CBBDQ values of PT+T group after treatment ($\bar{x}$=24,000) were higher than the values of PT group ($\bar{x}$=15.790), (Table 2).

In our study, the quality of life assessed using the PAC-QOL improved in both groups. Statistically significant results were obtained only in PT group (p=0.01, Table 2). The quality of life decreased as the scores obtained from the questionnaire increased. Constipation symptoms were positively correlated with quality of life (r=0.39; p=0.03). Satisfaction scores for parents and patients who were satisfied with the treatments used in the study were statistically significant in both groups (p=0.00, Table 2). The PAC-QOL (first part) and PAC-QOL (satisfy part) values of the patients before and after treatment did not differ significantly between the groups (p>0,05; Table 2).

Before treatment, the total number of MTrPs in the core muscles decreased significantly after treatment in both groups (p=0.01; PT group, p=0.00; PT+T group, Table 3). The pressure-related pain threshold (ppt) and muscle strength of some of these muscles significantly increased only in the PT group (p<0.05; Table 3), (Figure 1). The number of MTrPs negatively correlated with satisfaction after treatment (r=-0.44; p=0.01). There was no statistically significant correlation between the ppt values and muscle testing (r > 0.05). Furthermore, there was no statistically significant difference between the groups in MTrPs and manuel muscle test values (p>0.05).

This is the first study to compared with physical therapy techniques and addition of TENS in Myelomeningocele on constipation. The results of this study show that the TENS and physical therapy combination is an effective tool for assessing the severity of fecal incontinence, symptom of constipation, bladder and bowel dysfunctions and changes in stool form.

Veiga et al. reported that TENS was effective in children with complaints of constipation in their research on constipated children aged 4-14 years [8]. In parallel with the results of this study, we observed that the symptoms of constipation were reduced in the PT + T group. Furthermore, Dinning et al. emphasized the need to optimize TENS parameters in children with slow colon transit and reported promising potential as a therapy.

In a study emphasizing the importance of bowel management in myelomeningoceles with constipation, it was stated that electrical stimulation is available in adults but limited in children [6]. We also examined the results of myelomeningocele with constipation using TENS.

As the symptoms of constipation are subjective in nature, they can be evaluated using questionnaires [8]. We assessed mainly constipation using PAC-QOL, PAC-SYM, BSS and other associated constipation questionnaires/scores.

Acar stated that SB is one of the diseases accompanied by constipation and that SB can be seen as a cause of chronic constipation [4]. More than half of both groups included in our study had forms of type 1 and type 2 stool at baseline according to the BSS (n=9 PT group, 64.2%; n=8 PT+T group, 57.14%). In addition to constipation, 1 child in the PT group had form a type 6 stool, 1 child had a type 7 stool, and 1 child in the PT+T group had a type 5 stool. In our study, there were no children in the form of type 1, type 5, type 6 or type 7 stool in either groups. In the PT group, 1 child (7.14%) remained in the form of type 2 stool, while the other 13 children reached the form of type 3 and type 4 stool. In the PT+T group, 3 children (21.4%) remained in the form of type 2, 11 children reached form of type 3 and type 4 stool. In conclusion, our study showed that stool forms changed from type 1-2 to type 3-4 in the PT group (n=5; 35.7%) and PT+T (n=9; 64.2%) according to BSS with no significant difference between the groups. According to the results, physiotherapy and TENS can be used to change stool forms.

Although Cameron et al. reported that in a study in which 13% of patients with spina bifida did not find a relationship between BSS score and constipation symptoms, in our study, it was observed that abdominal discomfort and fullness caused by constipation in the both of groups turned into a normal feeling of stool, and the families reported that their children told them that they wanted to go to the toilet for defecation [13].

**Table 3:** *Myofascial Trigger Points, Pressure-Pain Threshold and Muscle Strength Testing Values*

| Number of Myofascial Trigger Points (MTrPs) | | PT group | | | PT+T group | | | Manual Muscle Strength Test Values (ACSM) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PT group | | | | PT+T group | | |
| | | Before | After | *p* value | Before | After | *p* value | Muscles | Before | After | *p* value | Before | After | *p* value |
| | | 5.43±3.32 | 2.86±2.71 | **0.01** | 4.50±2.56 | 3.00±2.77 | **0.00** | | | | | | | |
| **Pressure Pain Threshold Values (ppt)** | M. İliopsoas | 1.89±0.69 | 3.75±0.97 | **0.02** | 2.08±0.68 | 2.88±1.35 | 0.06 | M. İliopsoas | 1.92±2.09 | 1.85±2.03 | 0.33 | 3.21±1.84 | 3.28±1.85 | 0.33 |
| | M. Rectus abdominis | 1.82±0.54 | 3.11±0.69 | **0.00** | 2.67±0.98 | 3.16±1.17 | 0.23 | M. Rectus abdominis | 3.07±0.82 | 3.42±1.01 | **0.01** | 3.35±1.21 | 3.57±1.15 | 0.08 |
| | M. Obliquus externus abdominis | 1.94±0.82 | 3.35±1.05 | **0.00** | 2.49±0.92 | 3.04±1.24 | 0.52 | M. Obliquus externus abdominis | 2.92±0.82 | 3.21±0.97 | **0.04** | 3.07±1.20 | 3.14±1.23 | 0.33 |
| | M. Quadratus lumborum | 2.62±0.33 | 3.80±0.28 | 0.20 | 4.10±0.43 | 4.13±1.61 | 0.96 | M. Quadratus lumborum | 1.57±2.24 | 1.50±2.17 | 0.33 | 2.21±2.19 | 2.28±2.19 | 0.33 |

ACSM *American Collage of Sports Medicine*
Values in bold indicate a significance of $p<0.05$

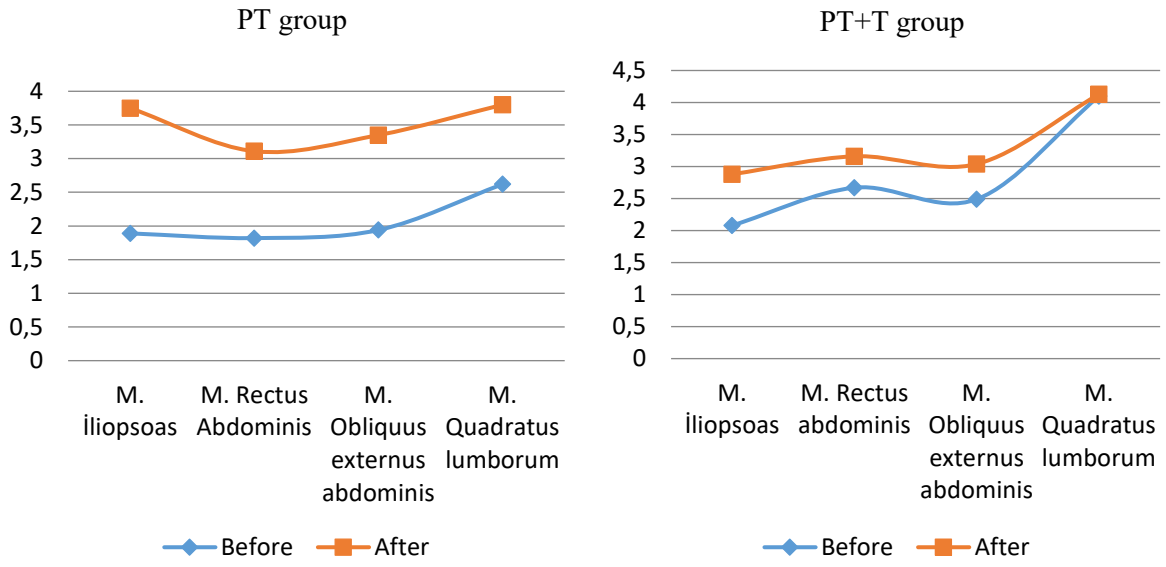


**Figure 1:** Pressure-Pain Threshold Values

An article on conservative management of spina bifida in children older than 5 years states that the treatment chosen should minimize the risk of constipation in patients with constipation due to bladder and bowel dysfunction [14]. Therefore, we tried to minimize constipation in our study and all the children with chronic constipation who participated in our study had bladder dysfunction (overactive neuropathic bladder). According to the literature, one of these methods is to provide conscious and correct bowel movements by training the pelvic floor muscles [15]. The aim of our study was to enable children with myelomeningocele to consciously urinate and defecate by sensing the pelvic floor muscles through correct diaphragmatic breathing. For this purpose, these children were toilet trained by our study's physiotherapist. Regular voiding and bowel movements were managed through this training. In an evaluation of this education, the Childhood Bladder and Bowel Dysfunction Questionnaire (CBBDQ), which asks about both bladder and bowel problems, was used to draw parents' attention to the relationship between bladder and bowel problems. Although the CBBDQ questionnaire has not been used in patients with spina bifida before, the questionnaire can be confidently used in clinical practice to evaluate and quantify symptoms of bladder and bowel dysfunction in pediatric patients [16]. As a result of our study, although improvement was observed in both groups according to CBBDQ values, greater improvement was observed in the PT group.

We observed that parents in the PT+T TENS group were more interested in TENS than physical therapy techniques; therefore, toilet training and other manual techniques, which we recommended in our treatment approach, remained in the background. The reason parents in the PT+T group were more interested in TENS might be that it was applied to the sacral region. This may have caused the PT+T group to benefit less from our treatment according to the PAC-SYM and CBBDQ questionnaires. However, according to the results of our study, physical therapy has positive effects on constipation with or without TENS; therefore, the treatment method can be determined according to the preference of the patient and/or therapist.

Pediatric gastroenterologists and surgeons have reported that chronic constipation seen in patients with spina bifida may lead to fecal incontinence and therefore should be included in the bowel management program from the age of 5 years [14]. In our study, a decrease was observed in the severity of fecal incontinence along with a decrease in constipation symptoms 8 children in PT group and 10 children

in PT+T group. However, improvement and initial status were greater in the PT group. If there were no differences between the groups, different results would have been obtained.

The severity of fecal incontinence that we assessed using FISI included symptoms of gas, mucus, liquid and solid fecal incontinence. According to our experience, gas accumulation in the abdomen and intestines is one of the symptom that patients often suffer from. In our study, we observed that abdominal massage and strengthening exercises of the abdominal muscles increased gas output in both groups.

Brochard et al. stated that appropriate management strategies for bowel problems in adults with spina bifida, revealed that 85% of patients, regardless of their neurological level, had a negative impact on their quality of life due to chronic constipation [7]. The results of our study showed that, the quality of life improved in both groups (50% PT group; 42.8% PT+T group). Although there are different quality of life questionnaires for children with SB in different age groups in the literature, common questionnaires have also been administered for 5-21 years [5], 3-12 years [17]. The quality of life questions evaluated with the PAC-QOL in our study may have been insufficient to question the emotional states and symptoms of children. According to our clinical observations, there may also be a possibility that the answers given in the children's questionnaire about embarrassment are not correct. The results of our study would have been more impressive if there had been a questionnaire on children's changing cognitive capacity, reading skills and emotional development in our language. Nonetheless, satisfaction with our treatment approach was high in both groups without difference, based on responses to the last 4 questions of this questionnaire, which questioned their satisfaction with toileting patterns and received treatments.

Ashrafi et al. stated that MTrPs can negatively affect the muscle function in area that assist with bowel movements in patients with chronic constipation compared to healthy people [3]. Therefore, in our study, ischemic compression was applied to the MTrPs found in the abdominal muscles that support defecation. It was observed that these muscles had an increase in ppt as assessed after treatment and a reduction in the total number of MTrPs in both groups. The reduction in the number of MTrPs may have enabled the muscles to maintain normal function, and consequently, improvement in constipation-related symptoms in both groups.

Although the number of MTrPs decreased in both groups, an increase in ppt was observed only in the PT group. In the PT+T group, TENS had no advantage over the threshold of the abdominal trigger points. There were no significant differences between the groups before and after treatment. It is considered that the ppt of the PT+T group of cases may be lower. In response, it is stated in the literature that TENS may vary depending on whether the area where the ppt is measured is the most painful and the parameters of TENS [18].

According to the results of a study on healthy volunteers by Çelik D and Yeldan İ in 2011, it was observed that those with MTrPs had lower muscle strength than those without [19]. In our study, manual muscle testing was performed on the innervated muscles according to the neurological level of the patients, and it was observed that the ppt of the rectus abdominis and external oblique abdominis muscles increased in PT group the PT group while this benefit was not observed in the PT+T group. Although there was no statistical difference in ppt values between the groups, the difference between the two groups in this regard is thought to be due to the increased muscle strength of patients in the PT group, who had an increased ppt for pain. This suggests that the reduction in pain due to applying pressure to the MTrPs has a positive effect on muscle function. In addition, pediatric gastroenterologists or surgeons are frequently present in the region for surgical procedures to ensure continence, improve quality of life, and for emergency reasons [20]. Therefore, destruction of these muscles occurs through surgical

incision. This can negatively affect the function of muscles in the abdominal and groin areas, increasing the risk of chronic constipation**.**

These findings show that PT and TENS can be used to treat myelomeningocele with chronic constipation.

## 4 Conclusions

Chronic constipation is common in patients with myelomeningoceles. In general, only TENS and physiotherapy techniques have been studied. Our study is the first randomized trial in which TENS was added to the physiotherapy methods. As a result of this study, the physical therapy approaches included manual abdominal massage, ischemic compression of trigger points, breathing exercises, rib mobilization, sensory stimulation of the gluteus maximus and rectus abdominis muscles, and strengthening exercises of the "core" area muscle techniques, is effective on the symptoms of chronic constipation, severity of fecal incontinence, quality of life and the number of myofascial trigger points. In addition, TENS is effective on stool form, TENS has no superior effect on symptoms of chronic constipation, severity of fecal incontinence, or bladder-bowel dysfunction, we believe that TENS may have a potential effect with physical therapy.

## 5 Declarations

### 5.1 Study Limitations

All questionnaires were filled in by the families by asking 4 illiterate children in the PT group and 5 illiterate children in the PT+T group.

Secondly, our study should be carried out in difficult conditions and with hygiene measures due to the COVID pandemic.

### 5.2 Acknowledgements

There is no person or institution contributing to this research other than the authors.

### 5.3 Funding source

No financial support was received for this research.

### 5.4 Competing Interests

There is no conflict of interest in this study.

### 5.5 Authors' Contributions

**Corresponding Author Özge ÖZDEMİR AYLA:** Developing ideas for the research and article, planning the materials and methods to reach the results, taking responsibility for the experiments, organizing and reporting the data, taking responsibility for the explanation and presentation of the results, taking responsibility for the literature review during the research, taking responsibility for the creation of the entire manuscript or the main part.

**Gönül ACAR:** Developing hypotheses for the research and article, taking responsibility for the creation of the entire manuscript or the main part, reworking not only in terms of spelling and grammar but also intellectual content or other contributions

**Şeyhmus Kerem ÖZEL:** Planning the materials and methods to reach the results, taking responsibility for the experiments, organizing and reporting the data.

**Emine ATICI:** Taking responsibility for the literature review during the research, taking responsibility for the creation of the entire manuscript or the main part, reworking not only in terms of spelling and grammar but also intellectual content or other contributions.

## 6 Human and Animal Related Study

### 6.1 Ethical Approval

The ethics committee for this study was approved by the Clinical Research Ethics Committee of the Marmara University Faculty of Medicine (protocol number 09.2020.07).

### 6.2 Informed Consent

Informed consent form was obtained from all participants for the study that they agreed to participate in the study.

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# Organ Nakli Hastalarının Taburculuk Sonrası Yaşadıkları Zorluklar ve Gereksinimler

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## ÖZ

Organ nakli, cerrahideki ilerlemeler ve immünosüpresif ilaçların gelişmesiyle beraber işlev ve fonksiyonunu yitiren organlar için en etkili tedavi yöntemidir. Ancak organ nakil hastaları ameliyat sonrası evde psikolojik, fizyolojik ve sosyal bazı zorluklar yaşamaktadırlar. Nakilden sonra hastalar yaşamlarının büyük çoğunluğunu evde geçirmektedir. Nakil sonrası hastalar başta psikolojik zorluklar olmak üzere fizyolojik, sosyal ve diğer zorluklar yaşamaktadırlar. Hastaların bu zorluklarla başa çıkması için bazı gereksinimleri oluşmaktadır. Hastalar en fazla psikolojik alanda bir ihtiyaç duymakla beraber eğitim ve bilgi ihtiyacı, sosyal ve diğer ihtiyaçların karşılanma hissi duymaktadırlar. Ayrıca organ nakli hastalarının yaş gruplarına ve cinsiyetlerine göre karşılaşılan zorluklar ve gereksinimleri değişebilmektedir. Bu nedenle organ nakli olan hastaların evde bakımlarının düzenli yapılması ve sosyal desteğin sürdürülmesi hastanın yaşam kalitesini yükseltmesi açısından önemlidir. Hastalara organ nakli sonrası sunulan taburculuk eğitiminin ve sağlanan bilgilerin yeterli ve açık olmadığı görülmektedir. Sağlık profesyonelleri organ nakli sonrası hastaların karşılaşacakları zorluklar ve gereksinimleri önceden belirleyerek hastaya özgü eğitim vermelidir. Ameliyat sonrası hasta ve hasta yakınları ile etkili iletişimin sağlanması, hastaların bu süreci daha kolay atlatması ve yaşam kalitesini yükseltmesi açısından oldukça önemlidir.

**Anahtar Kelimeler:** Organ nakli, zorluklar, gereksinimler, hemşirelik

# Challenges and Needs of Organ Transplantation Patients After Discharge

## ABSTRACT

Organ transplantation is the most effective treatment method for organs that have lost their function with the advances in surgery and the development of immunosuppressive drugs. However, organ transplant patients experience psychological, physiological, and social difficulties at home after surgery. After the transplantation, the patients spend most of their lives at home. After transplantation, patients experience physiological, social, and other challenges, especially psychological difficulties. There are some requirements for patients to cope with these difficulties.

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Patients mostly feel of need in the psychological field, as well as the need for education and information, and the feeling of meeting their social and other needs. In addition, the difficulties and needs of organ transplant patients may vary depending on age groups and genders. Therefore, it is crucial to provide regular home care and maintain social support for patients with organ transplants to increase the quality of life of the patient. It is seen that the discharge education and the information provided to the patients after organ transplantation are not sufficient and clear. Health professionals should provide patient-specific training by determining the difficulties and needs that patients will encounter after organ transplantation. Ensuring effective communication with patients and their relatives after the surgery is very important for patients to get through this process more easily and to improve their quality of life.

**Keywords:** Organ transplantation, challenges, needs, nursing

## 1 Giriş

Organ nakli; vücutta görevini yapamayan bir organın yerine canlı ya da ölü bir vericiden alınan sağlam bir doku veya organın hasta kişiye nakledilmesidir. Organ nakli, günümüzde diğer tedavi yöntemleri ile tedavi edilemeyen ve yaşamı tehdit eden son dönem organ yetmezliği olan hastalara önerilen yaşamı koruyucu ve sürdürücü en iyi tedavi seçeneğidir [1, 2]. Organ nakilleri bir canlıdan başka bir canlıya veya kadavradan başka bir canlıya nakil şeklinde gerçekleşmektedir. Kadavradan nakil; çeşitli durumlar nedeniyle yoğun bakımda tedavi ediliyorken beyinin geri dönüşsüz hasarı (beyin ölümü) gerçekleşen hastanın yakınları ya da hayatta iken istediğini, bağış kartı ve benzeri şekillerde beyan etmiş olmasına istinaden yapılan nakil işlemleridir [3–5].

Ülkemizde kalp, akciğer, karaciğer, ekstremiteler, kornea, tendon, kıkırdak doku, kas doku, kemik, ince bağırsak, böbrek, pankreas, yüz ve saçlı doku veya vücudun tamamı bağışlanabilmektedir. Kadavradan bu doku/organlar ile nakil yapılabilmekte canlıdan canlıya ise sadece karaciğer ve böbrek nakil edilebilmektedir [3–5]. Organ nakli ile ilgili süreçler; çeşitli kanun, yönetmelik, genelge ve yönergeler aracılığıyla yasal düzenlemeler çerçevesinde yapılandırılmıştır. Organların elde edilmesi, organların dağıtılması, organ ve hastaların eşleştirilmesi, organ nakillerinin gerçekleştirilmesi ve diğer tedavi-takip süreçleri normal bir hastane ameliyatı olarak ya da gelişi güzel bir şekilde değil bu yasal düzenlemeler çerçevesinde Ulusal Koordinasyon Merkezi ve Bölge Koordinasyon Merkezleri aracılığıyla organ nakli koordinasyon sistemi ile ulusal düzeyde koordineli bir şekilde sürdürülür [1, 6, 7].

Son yıllarda özellikle immünosüpresif ilaçların ve cerrahi tekniklerin ilerlemesinden dolayı dünya genelinde organ nakli sayısında büyük bir artış meydana gelmiştir [8, 9]. Amerika Birleşik Devletleri'nde (ABD) sadece 2022 yılında 42800 organ nakli gerçekleştirilmiş olup günümüze kadar toplamda bir milyondan fazla organ nakli yapılmıştır [10]. Ülkemizde ise 2021 yılında 7762 organ nakli yapılırken toplam bekleyen hasta sayısı 22660 olarak belirtilmiştir [11]. Özellikle, kronik organ yetmezlikleri gibi dahili hastalıkların tedavisinde önemli bir yeri vardır. En sık kullanılan hastalıklar böbrek yetmezliği, karaciğer yetmezliği ve kalp yetmezliği hastalıkları olup en sık böbrek nakli yapılmaktadır [9, 12, 13]. Organ nakli; hastalıkları tedavi etmek ve yaşamı kurtarmak amacıyla yapılmasının yanı sıra hastaların yaşam kalitesini arttırması ve yaşam sürelerini uzatması gibi birçok fayda sağlamaktadır [14–18]. Chaudhry ve arkadaşlarının (2022) böbrek nakli yapılan hastalar ve bekleme listesinde olan böbrek yetmezliği hastaları ile gerçekleştirdiği bir sistematik derleme ve metaanaliz çalışmasına göre; böbrek nakli olan hastaların uzun vadeli (en az bir yıl) sağkalım oranlarının diyaliz hastalarına göre daha fazla olduğu belirtilmiştir [19].

Bütün organ nakillerinde, nakil yapılmadan önce hastanın ciddi bir şekilde değerlendirilmesi, eşleştirilmesi, görüntülenmesi ve bekleme prosedürlerinin yapılması zorunludur. Organ nakil işlemi sırasında hastalar fizyolojik, psikolojik, sosyal ve manevi yönden sağlık ekibinden yardım alma ihtiyacı

duymaktadır. Sağlık ekibi hastanın sadece fiziksel durumu değil aynı zamanda mental durumuna da dikkat etmek durumundadır [20, 21]. Organ nakli; hastaların yaşam sürelerini uzatmasına rağmen enfeksiyon, organ reddi, malignite ve hatta ölüm gibi ameliyat sonrası birçok komplikasyon ve zorluğu beraberinde getirmektedir. Nakil sonrasında hastalar uzun süre immünosüpresif ilaç kullanma durumu ve kullanılan ilaçların yan etkilere bağlı olarak birçok fiziksel, mental ve sosyal zorluklarla yaşamakta olup ameliyat sonrası uzun süre bakıma ihtiyaç duyulması gibi gereksinimlerle yüzleşebilmektedir [22, 23].

Nakil sonrası gelişen bütün bu zorluk ve gereksinimler taburculuk sonrası evde bakım sürecinde sağlık profesyonelleri tarafından desteklenmeli ve bu konuda gerekli destek sürdürülmelidir. Nakil sonrası hastalarda yeterli bakım ve desteğin sağlanmaması başarılı bir tedavi sürecini sürdürebilmenin önündeki en büyük engellerdendir [24, 25]. Nakil, hastalara yeni bir yaşama şansı verse de bu dönem duygusal açıdan zorlu bir süreçtir. Uzun bekleme süresinin psikolojik sıkıntısından sonra yapılan nakil hastaya her ne kadar bir sevinç getirse de ameliyat sonrası hastanın nakil risklerini alma, organların akut ve kronik reddi, ilaç rejimlerine yaşam boyu uyulması gerekliliği, immünosüpresif ilaçların kalıcı yan etkileri, yeni organların adaptasyonu, greftin bakımı, yenilenmesi ve geleceği gibi birçok fiziksel ve mental zorluklar yaşamasına neden olabilmektedir [25–27]. Şahin'in (2018) Sol ventriküler destek cihazı ve kalp nakli operasyonları sonrası hastaların yaşadıkları sorunlar ile ilgili yapmış oldukları çalışmada; kalp transplantasyon sonrası hastalarda tremor, titreme, diyabet, osteoporoz, hipertansiyon ve enfeksiyon geliştiği belirtilmiştir. Ayrıca literatürde kalp transplantasyonu sonucu hastaların yaşadıkları komplikasyonlar; kardiyak allogreft vaskülopati, akut rejeksiyon, enfeksiyon ve malignite olarak belirtilmiştir [28].

Hastanın nakil sonrası fiziksel ya da mental durumunda yaşayacağı bir eksiklik ya da yetersizlik algısı bireyi bu gereksinimleri karşılamak için harekete geçmeye zorlar. Gereksinimlerin karşılanması bireyin kaygı ve sıkıntı düzeyini azaltacaktır. Aksine yaşanabilecek sıkıntılar hastaların durumu zorlaştıracak ve kaygısını daha da artıracaktır [29]. Kugler ve arkadaşlarının (2014) yapmış oldukları çalışmada; kalp nakli sonrası uyum sorunu yaşayan bireylerde depresyon görülme oranını %14,8 olarak bulurken bu oran literatürde %9 ile %37 arasında değişmektedir [30].

Bu nedenle sağlık profesyonelleri, ameliyat sonrası dönemde nakil alıcılarının evde yaşadıkları ve yaşayabilecekleri zorlukları belirlemesi ve hastaların ihtiyaçlarının bu yönde karşılanması önemlidir. Bu derlemenin amacı, güncel literatür kaynaklarıyla organ nakli ameliyatı sonrası bakım alan organ nakil alıcılarının evde karşılaştıkları zorluklar ve gereksinimleri ilgili bilgilerin bir bütün halinde sunularak başta hemşireler ve diğer sağlık profesyonellerine bir rehber sunmaktır.

## 2 Organ Nakli Alıcılarının Taburculuk Sonrası Yaşadıkları Zorluklar

Organ nakli alıcılarının organ nakli sonrası evde yaşadıkları zorluklara bakıldığında; psikolojik, fizyolojik, sosyal ve diğer zorluklar olarak gruplandırılmaktadır [24, 31–35].

### 2.1 Psikolojik zorluklar

Organ nakli alıcıları eş zamanlı olarak birçok zorlukla yüzleşebilmektedir. Bu zorlukların en yaygın olanı ise bireyin yaşamış olduğu psikolojik zorluklardır. Gündüz ve Akyolcu'nun (2020) yapmış oldukları çalışmada; hastaların tamamında organ reddine ilişkin korku yaşadıklarını belirtmişlerdir. Enfeksiyon ve greft disfonksiyonu gibi komplikasyonlarda hastaların psikolojik ve duygusal problemler yaşamalarına neden olmaktadır. Nakil sonrası hastaların günlük yaşamının çeşitli şekilde etkilenmesi ve ilaç bağımlılığı hastada depresyon, huzursuzluk ve anksiyeteye neden olmaktadır. Ayrıca ilaçların

getirdiği yan etkiler, greft kaybı korkusu, geleceği hakkında endişe ve ömür boyu kullanacağı ilaç kullanımı da stresi artırmaktadır. Organ nakli sonrasında hastaların fiziksel durumlarına bağlı olarak sıklıkla ruh hali değişimleri yaşadıkları, duygusal iniş çıkışlarla başa çıkmaya çalıştıkları, geleceğin belirsizliği ve greft kaybı tehdidiyle ilgili nedenlerden dolayı endişe ve depresyon yaşadıkları belirtilmiştir [36]. Gentile ve arkadaşlarının (2013) yaptıkları bir çalışmada nakil sonrası hastaların iki ya da üç immünusüpresyon ilaç aldıklarını, hastaların %72,7'sinin bedeninde bazı değişiklikler olduğunu, %27,1'inin cinsel sorunlar yaşadığını belirtirken [37], Seiler ve arkadaşları (2016) ve Yağil ve arkadaşlarının (2018) yapmış oldukları çalışmalarda nakil sonrası hastaların çoklu ilaç kullanımlarına bağlı yaşam kalitelerinin ve psikolojilerinin olumsuz etkilendiklerini ifade etmişlerdir [38, 39]. Hastaların bu süreçte, bu psikolojik zorluklara karşı, çeşitli aile içi ve dışı destek kaynaklarının yardımıyla psikolojik iyileşme ve olumlu bir şekilde duygusal geçiş yaşadıkları ifade edilmektedir [20, 24, 31, 33, 40–43].

## 2.2 Fizyolojik zorluklar

Hastaların organ nakli sonrası evde yaşadıkları fizyolojik zorluklara bakıldığında; fiziksel rahatsızlık, ağrı, enfeksiyon, yorgunluk, uyku bozukluğu, immünosüpresif ve antirejeksiyon ilaçların uzun kullanımına bağlı yan etkiler ve çeşitli komplikasyonları içermektedir. Bu çoklu sendromlardan dolayı hastanın hastaneye tekrar yatışı, günlük yaşam aktivitelerini sınırlı yerine getirme ve yaşam kalitesinin azalmasına neden olmaktadır. Ayrıca, hastalarda görülen çeşitli psikolojik zorluklar ve ağrıdan dolayı da fiziksel engeller yaşadıkları belirtilmektedir [20, 29, 31, 32, 40, 43–46].

Şahin'in (2018) yapmış oldukları çalışmada; banyo yapma, deniz/havuz girememe (%71,4), uyuyamama (%23,8), toplu taşıma araçlarını kullanmamaya (%9,5) ilişkin sorunlar yaşadıklarını ifade etmişlerdir. Ayrıca nakil sonrası %66,7'sinde yaşamında değişiklik yaptığı, %93,3'ünde enfeksiyondan korunmak için sosyal izolasyon yaptığı, %93,3'ünde nakil sonrası sosyal destek almadığını, %60'ının işe devam etmediğini ve %83,4'ünde nakil sonrası sağlığı kötü olduğu için çalışamama ya da erken emekli olmayı düşündüklerini belirtmiştir [28].

## 2.3 Sosyal zorluklar

Organ nakli alıcıları, diğer kişilerle olan ilişkilerini ve hastaların kendi imajlarını etkileyebilecek fizyolojik nedenlerden dolayı sosyal olarak kendilerini izole etmeleri gerektiği hissi duymaktadır. Organ naklinden sonra hastalar yeni yaşam tarzı ve sosyal roller benimseme ihtiyacı duymaktadır. Örneğin; enfeksiyondan kaçınmak için hastalar diğer kişilerle sosyal temaslarını sınırlandırma gerekliliği hissetmektedir. Ayrıca tıbbi ve cerrahi işlemlerin maliyetlerinden dolayı hasta ailelerinin organ nakli sonrası ekonomik zorluklarla da yüzleştikleri ifade edilmektedir [24, 31–33, 42, 44]. Seiler ve arkadaşlarının (2016) yapmış oldukları bir çalışmada; nakil sonrası hastaların yarısının sık kontrole gitmeleri, ilk aylarda hastaneye yakın bir yer kiralamanın aciliyeti, sosyal çevrelerinden uzaklaşmaları, maske takma zorunlulukları, enfeksiyon korkusu, hasta bakıcılar ve sağlık uzmanları ile sınırlı iletişimleri nedeniyle sosyal izolasyon yaşadıklarını belirtmişlerdir [38]. Ayar ve arkadaşlarının (2022) yapmış oldukları bir çalışmada ise, organ naklinde hem alıcı hem de vericiler arasında damgalanmanın kadınlarda daha yüksek olduğu bulunmuştur. Ayrıca vericilerin tamamına yakını bağış yaptıkları için başkalarının kendileri hakkında olumsuz bir izlenim edineceklerini ve sosyal damgalanma yaşamaktan korktuklarını ifade etmişlerdir [47].

### 2.4 Diğer zorluklar

Hastaların ilaç kullanım yönetimi gibi tıbbi zorluklar organ nakli sonrası evde yaşanılan diğer zorluklar arasında bahsedilmektedir. Hastaların uzun süre immünosüpresif ilaç kullanması gerektiğinden ilaç kullanımda uyum çok önemlidir. Nakil sonrası immünosüpresif kullanımına uyumsuzluk tedavinin başarısını kısa ve uzun dönemde olumsuz yönde etkilemekte, rejeksiyon, greft kaybı ve hatta ölüme kadar varabilen sonuçlara neden olabilmektedir [24, 29, 31, 33, 41, 48].

Kung ve arkadaşlarının (2012) kalp, akciğer ve karaciğer transplantasyonu yapılan hastaları içeren çalışmalarında immünosüpresif ilaç kullanımına uyumsuzluğun kalp nakli hastalarında %37, akciğer nakli hastalarında %44 ve karaciğer nakli hastalarında %50 oranında olduğu bildirilmiştir [49]. Ayrıca, literatürde kadın ya da erkek cinsiyetine sahip olmanın farklı zorluklara sebep olduğu belirtilmektedir. Erkeklerin gelecek belirsizliği, sosyal etkileşim ve erkeklik duygusunu etkileyen iktidarsızlık yaşamaları konusunda daha fazla stres ve kaygı yaşadıkları belirtilirken kadınların ise daha çok aile içi roller ile ilgili zorluklar yaşadıkları belirtilmektedir [24, 29, 31, 33, 41].

Van Ek ve arkadaşlarının (2017) yapmış oldukları çalışmada nakilden sonra hastalarda cinsel işlev bozukluğu prevalansının %46 olduğu, özellikle 40 yaş altındaki hastalarda cinsel işlevlerde iyileşme gözlense de ereksiyon yetmezliğinin %20-50 oranlarında devam edebildiği belirtilmiştir. Her ne kadar nakil sonrası cinsel işlev bozukluğu görülse de nakil öncesi duruma göre daha iyi sonuçlar elde edinilebilmektedir [50]. Rahman ve arkadaşlarının (2021) yapmış oldukları çalışmada böbrek nakil öncesi ve sonrası erektil disfonksiyon karşılaştırma sonuçlarına göre; nakil sonrası Uluslararası Erektil Fonksiyon İndeks skorlarının nakil öncesine göre daha yüksek olduğu ve testesteron seviyelerinde artış olduğunu belirtmişlerdir [51].

Nakil öncesi hastaların obez olma durumu nakil sonrası komplikasyon görülme oranını ve çeşitli zorluklar yaşamasını etkileyebilmektedir. Mousapour ve arkadaşlarının (2022) nakil öncesi obezite cerrahisi olup-olmama durumu ile ilgili nakil sonrası yaşanan komplikasyonlara yönelik yaptığı sistematik çalışmada nakil öncesi bariyatrik cerrahisi uygulanmayan hastalar arasında nakil sonrası ilk 5 yıl içinde %13,7 greft kaybı, %9,1 ölüm oranı gerçekleşirken bu oran bariyatrik cerrahi geçiren bireylerde %8,7 greft kaybı ve %2,8 ölüm oranı olarak gerçekleşmiştir. Nakil öncesi hastaların ek komorbiditelerin düzeltilmesi bu açıdan önemlidir [52].

## 3 Organ Nakli Alıcılarının Gereksinimleri

Literatürde; evde yaşayan nakil hastalarının karşılaştıkları zorlukların ötesinde, sağlık profesyonellerinin hastaların öncelikli gereksinimlerini dikkate alarak onların yaşam kalitesini geliştirebildikleri belirtilmektedir. Nakil hastalarının, fizyolojik, psikolojik ve sosyal bir iyilik hali içinde olabilmesi için birçok gereksinimi bulunmaktadır. Hümanistik psikolojinin öncülerinden Maslow, insanların temel ihtiyaçların karşılanmasının optimal sağlığı koruduğunu ifade etmiştir. Maslow'un ihtiyaçlar hiyerarşi teorisinde gereksinimler; fizyolojik (hava, solunum, yaşam yeri, uyku vb.), güvenlik (güvenlik duygusu, ağrının giderilmesi ve korunma), sevme ve ait olma (dostluk ve arkadaşlık), saygı duyma ve kendini gerçekleştirme gereksinimleri şeklinde en alt basamaktan en üst basamağa doğru ilerler. Maslow'a göre üst basamaktaki gereksinimlerin giderilebilmesi için alt basamaktaki gereksinimlerin karşılanmış olması gerekmektedir. Bu nedenle organ nakli alıcılarının organ nakli sonrası bakımları için temel gereksinimleri alt basamaktan üst basamağa doğru psikolojik, eğitim ve bilgi verme, sosyal ve diğer ihtiyaçlar şeklinde olması gerektiği ifade edilmektedir [24, 29, 41, 53]

### 3.1 Psikolojik gereksinimler

Organ nakli alıcılarının organ nakli sonrası evde en çok psikolojik yardım gereksinimi duymaktadır. Hastaların organ nakli sonrası duygusal ve manevi olarak desteklenmesi özellikle mental açıdan iyi hissetmeleri için çok önemli olduğu ifade edilmektedir. Ayrıca, nakil sonrası hastalarda fiziki ağrının yaşanması olumsuz duygular yaşanmasına neden olarak birçok psikolojik gereksinime yol açmaktadır. Nakil sonrası hastalar bakım veren kişilere daha fazla ihtiyaç duymakta ve hasta yalnız kaldığında bireysel rollerini ve kişisel ihtiyaçlarını karşılamakta zorlandıklarından, hastaların psikolojik gereksinimleri daha da artmaktadır [20, 24, 34, 54–57].

### 3.2 Eğitim ve bilgi alma gereksinimi

Literatürde, birçok hastanın nakil sonrası taburculuk sırasında yeterli ve açık bir şekilde bilgi ve eğitim almadıkları ifade edilmiştir. Hastaların nakil sonrası karışılacakları çeşitli zorluklara karşı başa çıkmaya yönelik eğitim ve bilgiye ihtiyaç duymaktadırlar. Eğitim ve bilgi hastanın kendi kendine bakım ihtiyacını karşılayabilmesi açısından önemlidir. Hastalara taburculuk sırasında verilecek eğitim ve bilginin hastanın günlük yaşam aktivitelerini daha etkin şekilde yerine getirmesini sağlayacağı ve yaşam kalitesini artıracağı belirtilmektedir [24, 32, 42, 58–60]. Soylu ve Ortabağ'ın (2017) böbrek transplantasyonu sonrası hastaların yaşam kalitesinin değerlendirdiği çalışmada; hastaların tedaviden sonra en çok yarar sağlayan ve yaşam kalitesinde önemli yükselme gösteren hasta grubunda genç hastalar yer aldığı ifade etmiştir. İleri yaş grubunda hastalarda ise hastalıklarına yaşla beraber komorbid hastalıklardaki artış, fiziksel güç kaybı, zihinsel alanda gerileme, sosyal yaşantıda kısıtlanmadan kaynaklandığını belirtmiştir. Ayrıca eğitim düzeyi düşük olan hastaların eğitim ve bilgi alma gereksinimlerinin daha fazla olduğunu belirtmiştir [61].

### 3.3 Sosyal gereksinimler

Nakil sonrası transplant hastaların, evde özellikle aile, arkadaş ve diğer ameliyat sonrası nakil hastalarından sosyal destek açısından gereksinim duydukları ifade edilmiştir. Hastaların yaşam kalitelerinin geliştirilmesi için aile ve arkadaşlarıyla etkileşim için desteklenmesi gerektiği kolektivist başa çıkma stilleri desteklenmelidir. Ayrıca hastaların ekonomik ihtiyaçlarının karşılanmaya yönelik desteklenmesi ve hastalara maddi yardımların yapılması gerektiği belirtilmektedir [24, 41, 54, 57, 62]. Ayar ve arkadaşlarının (2022) yapmış oldukları bir çalışmada; kolektivist başa çıkma puanlarının alıcı hastalara nazaran verici hastalarda daha yüksek olduğu belirtilmiş ve alıcı verici ailenin aile desteği görme ve din-maneviyat durumlarının yüksek olduğu ifade edilmiştir. Ayrıca nakil hastalarının sosyal ve ekonomik yönden desteklenmesi de başa çıkma stratejilerini geliştirdiklerini belirtmişlerdir [47].

### 3.4 Diğer gereksinimler

Nakil sonrası hastaların tıbbi gereksinimlerinin sağlık profesyonelleri tarafından desteklenmesi, hastalarda semptom ve kaygının azalmasına fayda sağladığı ifade edilmektedir. Ayrıca hastaların cinsiyet farklılığı ve yaş grupları arasındaki farklılıklar da hastalar arasında gereksinim farklılığı yarattığı belirtilmektedir [32, 34, 41]. Çelik ve arkadaşlarının (2019) kalp nakli olan bir hastanın sağlık profesyonelleri tarafından verilen destek ve önemi ile ilgili yapmış oldukları çalışmada; hasta ile görüşmeler süresince hastanın günlük su alımında artış, böbrek fonksiyon testlerinde düzelme, hastalığıyla ilgili umutsuz ve hastalığı reddedici temaların azaldığını, kişisel özbakımının daha iyi olduğunu, duygu ve düşüncelerini daha iyi bir şekilde paylaşmaya başladığını ve hastanın sağlık ekibi ile görüşmelerde ilk görüşmelere nazaran daha istekli olduğunu ifade etmişlerdir. Nakil sonrası hastalarda gelişebilecek komplikasyonlar ve kullanılan immünosüpresif ilaçların yan etkileri dikkate

alınarak, nakil öncesi dönemde ve nakil sonrası erken ve geç dönemde kişiye özel tıbbi beslenme tedavisi uygulanmalıdır. Böylece hem kardiyovasküler komplikasyon riskleri azaltılarak hem de immünosüpresif ilaçların yan etkileri en aza indirilerek, iyileşme süreci hızlandırılabilir, yaşam kalitesi artırılır ve rejeksiyon riski azaltılabilir [63].

Koimtzis ve arkadaşlarının (2022) böbrek nakli sonuçlarında D vitaminin rolü ile ilgili yapmış oldukları çalışmada, D vitamini eksikliği olan hastalarda greft fonksiyonlarında bozulma, akut rejeksiyon atakları, proteinüri insidansının daha yüksek olduğu ve hastaların sağkalım oranlarının daha düşük olduğu belirtilmiştir [64].

## 4 Organ Naklinde Hemşirenin Görev ve Sorumlulukları; Zorluk ve Gereksinimler İçin Yapılabilecek Uygulamalar

Organ naklinin tüm süreçlerinde hemşire, hastalar ile sürekli bir etkileşim içinde bulunması ve sağladığı eğitim, bakım ve iletişimi ile hasta üzerinde doğrudan istenilen etki potansiyeline sahip olması nedeniyle oldukça önemli bir rol almaktadır. Hemşire rol ve sorumlulukları ile yapılabilecek uygulamalar şu şekilde özetlenebilir [65-77].

- Organ nakli hakkında toplumu bilgilendirmek ve organ bağışı konusunda bilinçlendirmek.
- Ameliyat öncesi, esnası ve sonrasında diğer hemşire ve diğer sağlık profesyonelleri ile birlikte iletişim ve koordinasyonu sağlamak.
- Hasta ve ailesine organ nakli süreçleri, tedavi ve gerekebilecek diğer konularda eğitim sağlamak.
- Alıcı ve vericiye ameliyat öncesi süreçte diğer sağlık profesyonelleriyle birlikte ameliyat ve ameliyat sonrası süreçlerde yapılacak tetkik ve uygulamalar, oluşabilecek sorunlar, taburculuk sonrası dikkat edilmesi gereken noktalar için konusunda bilgi sağlamak.
- Alıcı ve vericiye ameliyat öncesi derin solunum, öksürük ve ekstremite egzersizlerini öğretmek.
- Ameliyat sonrası klinik süreçlerinde, alıcı ve vericiler için tedavilerin uygulanması, yaşam bulgularının izlenmesi, hemodinamik monitörizasyon, dren takibi, nörolojik izlem, ağrı yönetimi, kanama yönetimi, laboratuvar bulgularının takibi ve diğer tetkik, tedavi ve bakım işlemlerinin yapılması gibi temel hemşirelik bakımlarını sağlamak.
- Vericinin kendi günlük yaşamına en kısa sürede dönmesini sağlamak.
- Enfeksiyon riskine yönelik hemşirelik girişimlerini dikkatle sağlamak.
- Organ reddi ve diğer komplikasyonlar nedeniyle hastayı dikkatle izlemek.
- Taburculuk eğitimi ile hastayı ev yaşamına hazırlamak ve bireyin ve ailesinin kendi sağlık bakımında sorumluluk alması için cesaretlendirmek.
- Özellikle yara bakımı, ağrının yönetilmesi, taburculuk sonrası aktivite, komplikasyonların takibi gibi konularda etkin öğrenme yöntemleri kullanılarak eğitim sağlamak.
- İlaçların amacı, dozu, uygulama şeklin ve yan etkileri, reçete dışı ilaç kullanılmaması; immünsupresif ilaçların amacı ve gerekliliği, bu nedenle düzenli kullanılmasının önemi; rejeksiyon semptomları ve bu durumda sağlık merkezlerine başvurması; enfeksiyona karşı korunma, semptomlarını anlama ve bu durumda sağlık merkezlerine başvurma; el yıkamanın önemi; 3 ay gibi süre kalabalıktan kaçınma, ağırlık kaldırmama; dengeli ve düzenli beslenme; stres yönetimi ve sakin bir yaşantı sürme ve hastane kontrollerine uyma konularında eğitim ve farkındalık sağlamak.
- İmmünosupresyon tedavisinin etkilerini, enfeksiyonlardan korunmak için diğer uygulamalar yanında düzenli ağız bakımı ve diş kontrollerinin önemini anlatmak.

- Bireyin eğitim konuları ve temel öz bakım konularındaki becerilerini değerlendirmek ve güçlendirmek.
- Hastanın korku, depresyon, anksiyete, hüzün gibi ruhsal semptomlarını, baş etme yöntemlerini ve destek sistemlerini değerlendirmek, etkili baş etme yöntemlerini öğretmek ve kullanmasını sağlamak.
- Hastanın korku, anksiyete, üzüntü ve benzeri durumlarını kabul etmek ve önemsemek.
- Alıcı ve verici ile bütün dönemlerde güven verici ve empatik iletişim kurmak ve duyguların ifade etmesi için cesaretlendirmek.
- Hastaya zaman ayırmak ve değer verildiğini hissettirmek.
- Diğer meslek üyelerinden psiko-sosyo-spiritüel destek almak, hastanın bu hizmetlerden faydalanmasını sağlamak.
- Müzik, dikkati başka yöne çekme uygulamaları, meditasyon, nefes egzersizleri gibi depresyon, korku, anksiyete ve ağrı hafifletici uygulamaları hastalara öğretmek ve uygulatmak.
- Nakil deneyimlemiş hastalarla tanıştırmak, kendi deneyimlerini paylaşmak ve başka deneyimleri öğrenmek için sosyal ortamlar oluşturmak.

## 5 Sonuç ve Öneriler

Organ nakli, hastaların hayatta kalmaları için hayati bir rol oynar. Ancak, nakil alıcılarının ameliyat sonrası evde bakımları sırasında yaşadıkları zorluklar ve gereksinimleri iyileşme durumlarını etkileyebilmektedir. Bu nedenle organ nakli alıcılarının nakil sonrası karşılaştıkları ve karşılaşabilecekleri zorluklarını ve gereksinimlerini belirlemek, önlemek ve gidermek oldukça önemlidir. Organ nakli alıcılarının yaşadıkları zorluklar ve gereksinimlerine yönelik olarak ameliyat sonrası dönemde bakımın sürekliliğini sağlamak, nakil hastalarının bakım kalitesini artırmaktadır. Başta hemşireler olmak üzere sağlık ekibinin, hastaya bakım veren kişiler ile hastalar arasında yakın iş birliği yaparak hastaların ameliyat sonrası gereksinimlerini gidermesi hasta ve ailesi için önemlidir. Sağlık profesyonelleri, nakil sonrası hasta eve döndükten sonra özellikle psikolojik yönden olmak üzere diğer zorluklara karşı başa çıkma yöntemlerine yönelik hasta ihtiyaçlarına göre müdahale ve stratejiler geliştirmeli; hastaların karşılaştıkları ve karşılaşabilecekleri zorlukları fark edebilmeli, bunları hafifletecek ve önleyecek girişimlerde bulunmalıdır. Bu yaklaşım, nakil hastalarının operasyon sonrası hastane dışı süreçlerinde de kaliteli bir sağlık bakımının sağlanmasını ve böylece hastaların yaşam kalitelerinin yükseltilmesinde faydalar sağlayabilir.

## 6 Beyanname

### 6.1 Teşekkür

Bu araştırma için, yazarlar dışında katkı yapan kişi veya kurum bulunmamaktadır.

### 6.2 Finansman Kaynağı

Bu araştırma için herhangi bir finansal destek alınmamıştır.

### 6.3 Çıkar Çatışması

Bu çalışmada herhangi bir çıkar çatışması yoktur.

### 6.4 Yazarların Katkıları

**Kadir BAYSOY:** Araştırma konusu/makale fikri, gereç ve yöntemlerin planlanması, literatür tarama, yazım ve raporlama, dergiye gönderme ve diğer kurum/kuruluşlarla süreç ve yazışmaları yürütme.

## 7 İnsan ve Hayvanlarla İlgili Çalışma

### 7.1 Etik Onay

Bu çalışma, bir derleme makalesi olduğu için bir etik kurul onayına gerek yoktur.

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