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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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FACTORS IMPACTING HEMODIALYSIS TREATMENT ADHERENCE IN END-STAGE RENAL DISEASE PATIENTS RECEIVING IN-CENTER HEMODIALYSIS IN QASSIM REGION

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Abstract.

Background: End-Stage Renal Disease (ESRD) is a significant health concern globally, with hemodialysis (HD) being the primary treatment modality for patients with this condition. Adherence to HD sessions is crucial for optimal patient outcomes, yet non-adherence remains a common issue. This study aimed to evaluate the factors influencing adherence to HD sessions among ESRD patients in Qassim region.

Methods: A cross-sectional descriptive study was conducted involving 172 ESRD patients receiving in-center HD in Qassim region. Data were collected using a structured questionnaire that assessed demographic characteristics, adherence behaviors, and factors influencing adherence to HD treatment. Non-adherence was defined as missing one or more HD sessions per month or shortened one or more sessions by more than 10 min per month.

Results: The study found that 22(12.79%) of patients missed one or more HD sessions in the past three months, with the primary reasons being family or personal issues, health-related problems, and transportation difficulties. The majority of the patients (97.7%) acknowledged the importance of adhering to HD sessions. Factors significantly associated with non-adherence included patients' perception of the importance of HD sessions and experiences of post-dialysis fatigue. Lack of social support and post-dialysis hypotension were observed but not statistically significant.

Conclusion: Non-adherence to HD sessions in Qassim region is influenced by a combination of personal, social, and health-related factors. Addressing these factors through targeted interventions could improve adherence rates and, consequently, patient outcomes. Future research should focus on developing and testing such interventions.

Key words. Adherence, end-stage renal disease, hemodialysis, Qassim region, Saudi Arabia.

Introduction.

Chronic kidney disease (CKD) is a progressive illness that is characterized by structural or functional abnormalities of the kidneys, and it occurs in stages, ranging from stage 1 (mild) to stage 5, in which case it becomes end-stage renal disease (ESRD) [1]. When ESRD occurs, there is complete and irreversible loss of kidney function, at which stage dialysis or kidney transplant surgery are required [2]. According to Salah et al., between 9.1% and 13.4% of the global population today lives with CKD, with the prevalence being expected to increase, mainly due to increased prevalence of risk factors such as obesity and diabetes [2]. Given that these risk factors are highly common among the Saudi population, ESRD is a major health concern in Saudi Arabia.

The progression of kidney disease to ESRD can rapidly become fatal, with patients requiring renal replacement therapy (RPT), which can be in the form of hemodialysis, peritoneal dialysis (PD), or renal transplantation [3]. Although renal transplantation is considered the most effective treatment, hemodialysis is more common as it is more accessible and there is a shortage of kidneys for transplantation [4]. Moreover, a significant proportion of renal transplant surgeries are unsuccessful, necessitating continued hemodialysis treatment [5]. Hemodialysis, which is life-sustaining and critical to ESRD patients, involves the removal of waste products and excess fluid from the blood using an artificial kidney machine [6]. Today, about 69% of all RPT and 89% of all dialysis treatments are hemodialysis [6], Al Garni and Cooke estimating that in Saudi Arabia, there is an annual net growth in the number of hemodialysis patients by 6% [7].

The effectiveness of hemodialysis is as good as the adherence to the prescribed treatment. Non-adherence to hemodialysis treatment can be gravely costly to the patient, potentially leading to fluid overload, electrolyte imbalances, cardiovascular complications, and increased mortality rates [8]. Given how vital hemodialysis adherence is, it is important to understand the factors that influence adherence in specific contexts. Most of these factors are patient-specific, and may include literacy levels, knowledge about the disease, and attitudes towards treatment [9]. At the same time, however, other factors such as accessibility of healthcare resources, socioeconomic status, and location can influence adherence levels. This study aims to investigate the factors impacting hemodialysis treatment adherence in end-stage renal disease patients receiving in-center hemodialysis in the Qassim region of Saudi Arabia. The results of this study provide an understanding of these factors as they correlate with treatment adherence in Qassim.

Materials and Methods.

Study Design and setting:

A cross-sectional descriptive study was conducted to evaluate the factors impacting hemodialysis treatment adherence among patients with End-Stage Renal Disease (ESRD) receiving in-center hemodialysis in the Qassim region of Saudi Arabia.

The study was carried out at King Fahad Specialized Hospital (KFSH) in Buraydah, King Saud Hospital in Unaizah, AlRass General Hospital, AlMithnab General Hospital, and AlBadaya General Hospital. Data collection took place during patients' routine hemodialysis sessions from April to September 2024.

Study population:

The study population included all ESRD patients undergoing in-center hemodialysis in the Qassim region. Inclusion criteria were Saudi patients who had been on hemodialysis for more than three months. Patients undergoing hemodialysis due to acute kidney injury or any other acute condition, as well as those who had been on hemodialysis for less than three months, were excluded from the study.

Sampling and sample Size:

The sample size was calculated using Cochran's formula with a 95% confidence level (Z = 1.96), an expected proportion of adherence of 0.5 (maximum variability), and a margin of error of 5%. This yielded an initial sample size of 384. After applying the finite population correction based on an estimated hemodialysis population of 290 patients in the Qassim region, the final required sample size was approximately 172 participants. A non-probability convenience sampling method was employed, whereby patients who met the inclusion criteria were selected based on their availability and willingness to participate during the data collection period.

Data Collection Methods:

Data were collected using a structured questionnaire administered during patient interviews while they underwent hemodialysis. The questionnaire was adapted from a validated tool used in previous studies with modifications tailored to this study's objectives (1,10). The questionnaire covered demographic data, adherence behaviors, and factors influencing adherence to hemodialysis treatment. Non-adherence was defined as missing one or more hemodialysis sessions per month or shortened one or more sessions by more than 10 min per month. Importantly, any sessions missed due to hospitalization were not classified as non-adherence. This operational definition helped accurately capture adherence behaviors, focusing on voluntary or preventable factors while excluding those resulting from unavoidable medical circumstances.

Data Management and Analysis:

Collected data were entered into an Excel database for initial cleaning, which included identifying and removing outliers, duplicates, and errors. Following this, the data were coded and transferred to SPSS software version 26 for statistical analysis. Qualitative data were expressed as numbers and percentages, while quantitative data were presented as means and standard deviations (SD). Statistical significance was assessed using chi-square tests. To ensure the robustness of the chi-square test and meet its assumptions regarding expected cell frequencies, the five original categories for the fatigue variable ('No fatigue at all', 'Less than 2 hours', '2-6 hours', 'Till night', 'Till tomorrow') were consolidated into three broader categories for analysis: 'None to 6 hours' (combining the first three categories), 'Till night', and 'Till tomorrow'. A p-value of less than 0.05 considered significant.

Ethical Considerations:

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the Regional Research Ethics Committee. All participants provided informed consent before inclusion in the study, ensuring they were fully aware of the study's purpose, potential benefits, and risks. Confidentiality was strictly maintained by anonymizing patient data and securely storing it to prevent unauthorized access.

Results.

The study involved a total of 172 participants from various cities in Qassim region, with the majority residing in Buraydah (61%). The majority of the respondents were males (62.8%) while females were (37.2%). The age distribution indicated that nearly half of the participants were over 60 years old (48.8%), with smaller proportions in the 41-60 years (30.2%), 21-40 years (16.9%), and under 20 years (4.1%) age groups. In terms of marital status, the majority were married (69.2%), with the single group following closely (19.8%). Educational levels varied, with the largest group having completed secondary education (30.8%), followed by those with a bachelor's degree (19.8%). The employment status showed that nearly half of the participants were unemployed (46.5%), while 36% were retired, and 17.4% were employed (Table 1).

Regarding adherence to hemodialysis and associated factors among patients, table 2 indicates that most patients (88.4%) travelled more than 2 km to reach the nearest dialysis center. Among them, most covered a distance of 2-5 km (39.0%). Hypertension is the leading cause of CKD requiring dialysis (38.4%), followed by diabetic nephropathy (34.3%). The method of transportation to the dialysis center included family cars (52.3%), self-driven cars (31.4%) and privately driven cars (16.3%). As for the periods on dialysis, most of the patients have been on dialysis for more than 2 years (66.3%) followed by those between 1 and 2 years (22.1%) and 11.6% of the patients have been on dialysis for less than one year. It is also indicative that 22 (12.79%) missed dialysis in the last 3 months while 150 (87.21%) did not. Those who missed 1-2 sessions per month were 19 (11.05%), 3-4 sessions 3 (1.74%) and those who never missed a session in a month at 150 (87.21%). Most of the patients 168 (97.7%) acknowledged the importance of adherence to hemodialysis sessions while 4 (2.3%) did not. In regards to the time spent on each dialysis session, most patients spent 3.5 hours 87(50.6%) followed by those who spent 4hs and more 45 (26.2%). The most common reasons for missing dialysis were family or personal reasons (27.3%) and other medical appointments (27.3%), followed by health problems or symptoms of dialysis (13.6%) and transportation issues (13.6%). Less frequent reasons were depression (9.1%), travel (4.5%), and special occasions like Umrah (4.5%).

Table 3 reveals that none of the sociodemographic factors had a significant association with dialysis adherence. Gender differences were not statistically significant (p=0.072), though a higher percentage of non-adherent patients were female (54.5%) compared to males (45.5%). Age distribution also did not significantly impact adherence (p=0.654), with similar adherence rates across the age categories. Marital status was not significantly associated with adherence (p=0.301), although

Table 1. *The socio-demographic characteristics of the patients.*

Variable	Category	n(%)
City	AlBadaya	20(11.6%)
	AlMithnab	15(8.7%)
	AlRass	24(14%)
	Buraydah	105(61%)
	Unaizah	8(4.7%)
Gender	Female	64(37.2%)
	Male	108(62.8%)
Age	< 20 Years	7(4.1%)
	21 - 40 Years	29(16.9%)
	41 - 60 Years	52(30.2%)
	> 60 Years	84(48.8%)
Marital status	Divorced	4(2.3%)
	Married	119(69.2%)
	Single	34(19.8%)
	Widow	15(8.7%)
Educational level	No Education	32(18.6%)
	Primary	27(15.7%)
	Intermediate	23(13.4%)
	Secondary	53(30.8%)
	Diploma	2(1.2%)
	Bachelors	34(19.8%)
	Masters	1(0.6%)
Employment	Employed	30(17.4%)
	Retired	62(36%)
	Unemployed	80(46.5%)

Data presented in frequencies (n) and proportion (%).

Table 2. *Adherence to Hemodialysis and Associated Factors Among Patients.*

Distance to Nearest Dialysis Center	Less than 2 km	20(11.6%)
	2-5 Km	67(39.0%)
	5.1-10 km	64(37.2%)
	Outside town	21(12.2%)
Causes of CKD which leads to dialysis	Hypertension	66(38.4%)
	Diabetic nephropathy	59(34.3%)
	Glomerulonephritis	8(4.7%)
	Reflux nephropathy	4(2.3%)
	Polycystic kidney	9(5.2%)
	Unknown	59(34.3%)
Method of Transportation to Dialysis Center	Car (by Family member)	90(52.3%)
	Car (by Myself)	54(31.4%)
	Car (by Private driver)	28(16.3%)
Periods on Dialysis	< 1 Year	20(11.6%)
	1-2 years	38(22.1%)
	>2 years	114(66.3%)
Missed dialysis in last 3 months	No	150(87.21%)
	Yes	22(12.79%)
No. of sessions missed per month	Never	150(87.21%)
	1-2	19(11.05%)
	3-4	3(1.74%)
Enough Family & Social Support to adhere to hemodialysis	No	22(12.8%)
	Yes	150(87.2%)
Your doctor discusses the importance of dialysis adherence	No	21(12.2%)
	Yes	151(87.8%)

Time spent on each dialysis session (most sessions)?	< 3 hours	1(0.6%)
	3 hours	39(22.7%)
	3.5 hour	87(50.6%)
	4 hours or more	45(26.2%)
Adherence to hemodialysis sessions is important	No	4(2.3%)
	Yes	168(97.7%)
Do you have fatigue?	No fatigue at all	49(28.5%)
	Less than 2 hours	44(25.6%)
	2-6 hours	36(20.9%)
	Till night	23(13.4%)
	Till tomorrow	20(11.6%)
Do you have hypotension?	Never	58(33.7%)
	Rare	72(41.9%)
	Frequent	35(20.3%)
	Always	7(4.1%)
Days of dialysis?	Saturday, Monday and Wednesday	103(59.9%)
	Sunday, Tuesday and Thursday	69(40.1%)

Data presented in frequencies (n) and proportion (%).

Table 3. *Association between sociodemographic variables and adherence to dialysis.*

Variable	Category	Adherent	Non- Adherent	P value
City	AlBadaya	17(11.3%)	3(13.6%)	0.402
	AlMidhnab	15(10.0%)	0(0.0%)	
	AlRass	21(14.0%)	3(13.6%)	
	Buraydah	89(59.3%)	16(72.7%)	
	Unaizah	8(5.3%)	0(0.0%)	
Gender	Female	52(34.7%)	12(54.5%)	0.072
	Male	98(65.3%)	10(45.5%)	
Age	< 20 Years	7(4.7%)	0(0.0%)	0.654
	21 - 40 Years	24(16.0%)	5(22.7%)	
	41 - 60 Years	46(30.7%)	6(27.3%)	
	> 60 Years	73(48.7%)	11(50.0%)	
Marital status	Divorced	4(2.7%)	0(0.0%)	0.301
	Married	106(70.7%)	13(59.1%)	
	Single	29(19.3%)	5(22.7%)	
	Widow	11(7.3%)	4(18.2%)	
Distance to Nearest Dialysis Center	Less than 2 Km	19(12.7%)	1(4.5%)	0.603
	2-5 Km	58(38.7%)	9(40.9%)	
	5.1-10 Km	56(37.3%)	8(36.4%)	
	Outside town	17(11.3%)	4(18.2%)	
Educational level	No Education	25(16.7%)	7(31.8%)	0.308
	Primary	26(17.3%)	1(4.5%)	
	Intermediate	22(14.7%)	1(4.5%)	
	Secondary	44(29.3%)	9(40.9%)	
	Diploma	2(1.3%)	0(0%)	
	Bachelors	30(20.0%)	4(18.2%)	
	Masters	1(O.7%)	0(0.0%)	
Employment	Employed	26(17.3%)	4(18.2%)	0.147
	Retired	58(38.7%)	4(18.2%)	
	Unemployed	66(44.0%)	14(63.6%)	

Data has been presented as frequencies (n) and proportion (%). Chi-square test used to determine statistical significance. P-value considered significant at p<0.05 level.

non-adherence was slightly higher among widows (18.2%). The distance to the nearest dialysis center showed no significant relationship with adherence (p=0.603), and education level also did not show a significant effect (p=0.308), although non-adherence was slightly higher among those with no education (31.8%) and secondary education (40.9%). Employment status was similarly non-significant (p=0.147), although unemployed individuals showed a higher non-adherence rate (63.6%) compared to employed or retired patients.

Table 4 shows that the perceived importance of adherence to hemodialysis sessions had a statistically significant impact on adherence (p = 0.024), with patients who believe adherence is important showing a much higher adherence rate (98.7%) compared to those who do not (90.9%). Fatigue significantly impacted adherence (p = 0.035), with patients experiencing no fatigue or fatigue lasting up to 6 hours showing the highest adherence rate (76.7%). Patients who have fatigue till tomorrow tend to be less adherent 6(27.3%) with significant p-value (0.035). Other factors, such as periods on dialysis, family and social support, doctor discussions about dialysis adherence, time spent on dialysis sessions, hypotension, the day of dialysis, causes of chronic kidney disease (CKD), and method of transportation, did not show statistically significant associations with adherence (all p-values > 0.05). Specifically, patients with frequent hypotension showed lower adherence rates (40.9%), though this was not statistically significant (p = 0.066). Similarly, there was no significant difference based on the method of transportation to the dialysis center (p = 0.460), though patients driving themselves had slightly lower adherence (30.0%) than those driven by family members (52.7%).

Figure 1 show that among the 22 participants who missed dialysis, the most common reasons were family or personal reasons and other medical appointments, each accounting for 27.3% of cases. Dialysis-related health problems or symptoms (13.6%) and transportation problems (13.6%). Depression (9.1%), travel (4.5%), and special events like Umrah (4.5%) were less common reasons.

Table 4. *Different dialysis related factors associated with adherence to dialysis.*

Variable	Category	Adherent	Non-Adherent	P value
Periods on Dialysis	< 1 Year	17(11.3%)	3(13.6%)	0.290
	1-2 years	36(24%)	2(9.1%)	
	> 2 years	97(64.7%)	17(77.3%)	
Enough Family & Social Support to adhere to hemodialysis	No	17(11.3%)	5(22.7%)	0.135
	Yes	133(88.7%)	17(77.3%)	
Your doctor discusses the importance of dialysis adherence	No	20(13.3%)	1(4.5%)	0.240
	Yes	130(86.7%	21(95.5%)	
Time spent on each dialysis session (most sessions)?	< 3 hours	1(0.7%	0(0.0%)	0.402
	3 hours	35(23.3%)	4(18.2%	
	3.5 hours	78(52.0%)	9(40.9%)	
	4 hours or more	36(24.0%)	9(40.9%)	
Adherence to hemodialysis sessions is important	No	2(1.3%)	2(9.1%)	0.024
	Yes	148(98.7%)	20(90.9%)	
Do you have fatigue?	None to 6 hours	115(76.7%)	14(63.6%)	0.035
	Till night	21(14.0%)	2(9.1%)	
	Till tomorrow	14(9.3%)	6(27.3%)	
Do you have hypotension?	Always	7(4.7%)	0(0.0%)	0.066
	Frequent	26(17.3%)	9(40.9%)	
	Never	52(34.7%)	6(27.3%)	
	Rare	65(43.3%)	7(31.8%)	
Day of dialysis?	Saturday, Monday and Wednesday	89(59.3%)	14(63.6%)	0.701
	Sunday, Tuesday and Thursday	61(40.7%)	8(36.4%)	
Causes of CKD which leads to dialysis	Diabetic nephropathy	22(14.7%)	5(22.7%)	0.843
	Glomerulonephritis	8(5.3%)	0(0.0%)	
	Hypertension	30(20.0%)	3(13.6%)	
	Hypertension, Diabetic nephropathy	28(18.7%)	4(18.2%)	
	Hypertension, Polycystic kidney disease	1(0.7%)	0(0.0%)	
	Polycystic kidney disease	7(4.7%)	1(4.5%)	
	Reflux nephropathy	4(2.7%)	0(0.0%)	
	Unknown	50(33.3%)	9(40.9%)	
Method of Transportation to Dialysis Center	Car (by Family member)	79(52.7%)	11(50.0%)	0.460
	Car (by Myself)	45(30.0%)	9(40.9%)	
	Car (by Private driver)	26(17.3%)	2(9.1%)	

Data has been presented as frequencies (n) and proportion (%). Chi-square test used to determine statistical significance. P-value considered significant at p<0.05 level.

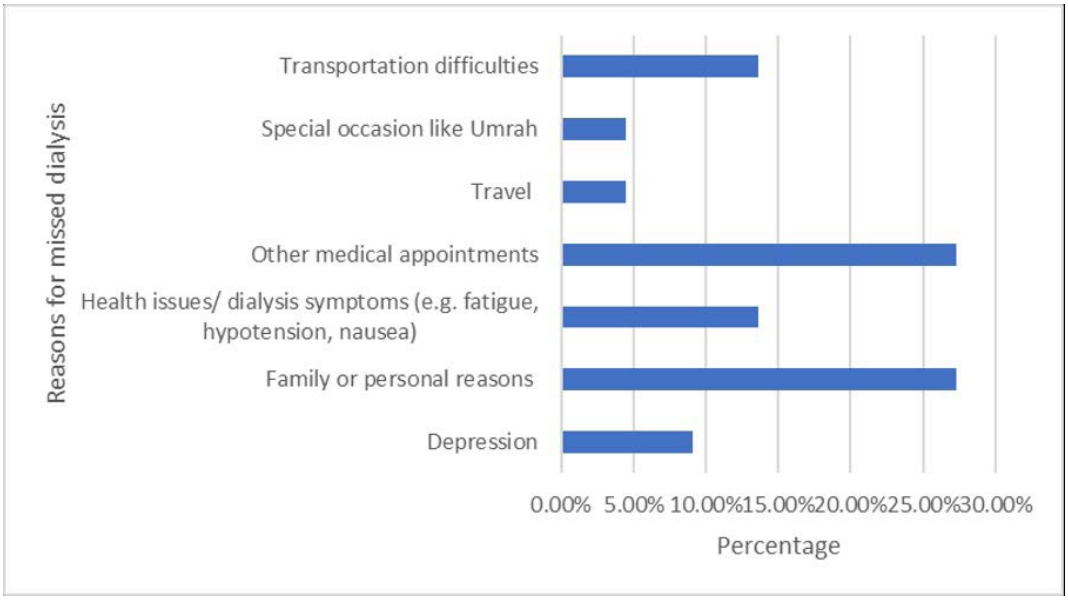

Figure 1. *Side bar-graph depicting the reasons for missed dialysis.*

Discussion.

Worldwide, it is estimated that over half a billion people are affected by or at risk of chronic kidney disease (CKD), with more than 80% of this growing population residing in developing countries. This suggests that over 70% of end-stage renal disease (ESRD) patients will likely emerge from low- or middle-income countries in the coming years [11]. While numerous studies worldwide have identified various factors influencing hemodialysis adherence in the management of ESRD, there remains a need to further investigate these factors in different geographical contexts, particularly in Saudi Arabia. This study aims to address this gap by exploring the factors affecting hemodialysis treatment adherence among ESRD patients receiving in-center hemodialysis in the Qassim region.

The study found that 87.2% of the patients adhered to dialysis routine or session in the last trimester and a majority 97.7% of them recognized the importance of undergoing through this noble process. While only 12.7% of the patients in this particular study reported missing of the dialysis session. The relatively high adherence observed in the Qassim region may be attributed but the fact that 87.8% of patients in the current study had discussed the importance of dialysis adherence with their physicians, which likely played a vital role in shaping their commitment to treatment. Regular communication and counselling from healthcare providers can significantly improve patients' understanding of the consequences of missed sessions. These finding report a higher rate of adherence compared to similar studies; for instance, a study by Elzorkany K et al carried out in Al-Ahsa dialysis center in KSA reported 26% rate of non-adherence among patients which was quite high compared to this of Qassim region [12]. A similar study also by Mukakarangwa et al undertaken in the republic of Rwanda among end-stage renal disease reported a higher non-adherence rate of 45% which was utterly higher compared to this particular study [13]. This varying of results in adherence outlay may be due to discussion with physicians and well-organized dialysis centers.

Although patients on dialysis for more than two years showed a higher percentage of adherence (64.7%), this difference was not statistically significant ($p = 0.290$). Therefore, we cannot conclude a definitive association between dialysis duration and adherence in our study. This finding does not align with other studies such as Ozen N et al. [14] and Kim H et al. [15], which reported that longer dialysis duration was associated with improved adherence. A possible explanation for this discrepancy may be the limited sample size in our study, which reduced the statistical power to detect such associations. Additionally, differences in patient populations and healthcare settings between our study and those reported in the literature could also account for the variation in results.

Notably, among the 22 (12.7%) participants in this study who missed dialysis, they identified family issues and other medical appointments 27.3% as the major reasons as to why. However, a study by Dantas LG et al. found that 44% of patients missed their routine dialysis due to financial constraints which is inconsistent with the findings from this particular study [16]. Though, also the financial barrier might be tied to family issues coming into agreement to this study uncovering.

Furthermore, the study did not find any statistically significant association between the sociodemographic characteristics of the participants and adherence to hemodialysis (p-value > 0.05). These findings are inconsistent with those of Mohamed S et al., in a study conducted in Tanzania, which established a statistically significant relationship (p-value < 0.05) between education, employment status, and adherence to dialysis [17]. This difference may be attributed to the fact that Qassim, being more urbanized, likely offers more decentralized and accessible healthcare services compared to Tanzania, thus minimizing the influence of demographic factors on patient adherence [17]. A similar study also carried out by Shdaifat EA et al established a statistically significant difference between employment status and patient adherence to dialysis which is contrary to the results reported by this particular study [18]. Though, there was no statistically significant difference witnessed across all the

demographic variables, females were reported to have higher rate of non-adherence 54.5% compared to their male counterpart 45.5%. Additionally, participants who were less educated like those without any formal education portrayed higher rates of non-adherence to dialysis 31.8% this is in support with a study by Abu Maloh HI et al. which attested that attune in educational support is vital in-patient adherence to dialysis. [19].

Regarding dialysis-related factors associated with adherence, the patients' perceived importance of adhering to hemodialysis showed a statistically significant association with actual adherence (p-value = 0.024). Additionally, patient-reported fatigue demonstrated a statistically significant relationship with dialysis adherence (p-value = 0.035). Specifically, patients who experienced fatigue lasting less than 6 hours after dialysis had a higher adherence rate (76.7%), while those whose fatigue extended into the following day exhibited a higher rate of non-adherence (27.3%). These findings align with a study by Khalil AA et al., which also established a significant association between patient fatigue and adherence to dialysis session attendance [20]. All other factors like, Hypotension, duration of dialysis, means of transport to dialysis center and family social support didn't have statistically significant association with adherence of dialysis (P-value >0.05).

This study acknowledges some limitations. Due to its cross-sectional design, it can identify associations but cannot determine causal relationships. The use of self-reported data collected during face-to-face interviews may have introduced recall bias and social desirability bias. Additionally, our analysis relied on bivariate chi-square tests, and we were unable to perform multivariate regression due to sample size limitations. This restricts our ability to identify independent predictors of adherence, and findings may be influenced by confounding variables. Furthermore, the use of a non-probability convenience sampling strategy may have introduced selection bias, limiting the generalizability of the results beyond the study population in Qassim region.

Relevance and Implications.

The findings emphasize the significance of addressing logistical barriers and social support to improve hemodialysis adherence. Targeted interventions, including educational programs for less-educated patients and psychological support for those experiencing depression, are crucial. The study suggests that healthcare systems should take a more integrated approach, and further research should explore long-term adherence patterns and the impact of interventions on patient outcomes.

Conclusion.

In conclusion, this research revealed some higher adherence rate to hemodialysis among ESRD patients in the Qassim region. Key factors that significantly influenced adherence included the patients' perceived importance of hemodialysis and the presence or duration of post-dialysis fatigue. Clinical symptoms behavioral factors (perception of importance), and practical/ logistical challenges (transport, appointments) are crucial areas to target in future adherence-improvement interventions. Social demographic factors did not influence adherence. It is hence important to enhance patient education as well as conducting personalized physician counselling to increase awareness of the importance of strict adherence to dialysis schedules.

Conflict of interest.

The authors do not have any conflict of interest.

Source of funding.

The authors do not have any conflict of funding to declare.

Ethical approval.

An ethical approval for the study was obtained from the Institutional Review Board (IRB) of the Regional Research Ethics Committee, Qassim Province, Saudi Arabia (approval number 607/46/420).

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