

Neuropathic Pain, Disability, and Health-Related Quality of Life Among Hemodialysis Patients in Palestine: A Multicenter Cross-Sectional Study

Mahdi Sawalha

An-Najah National University

Qassm Salman

An-Najah National University

Alqassam Alshaikh

An-Najah National University

Ahmad Quriash

An-Najah National University

Dima Malhis

An-Najah National University

Ahmad Rjoub

An-Najah National University

Mohannad Hassan

An-Najah National University

Mohammad Abuawad

m.abuawad@najah.edu

An-Najah National University

Research Article

Keywords: Neuropathic pain, Hemodialysis, Chronic kidney disease, Pain-related disability, Quality of life, PainDETECT, Cross-sectional, Palestine

Posted Date: October 6th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10709819/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Neuropathic pain is a common but underrecognized contributor to reduced quality of life and disability in hemodialysis patients, yet prevalence data from the Middle East, including Palestine, remain scarce; this study aimed to estimate the prevalence of a likely neuropathic pain component among hemodialysis patients in the West Bank and examine its associations with pain-related disability and health-related quality of life.

Methods

This multicenter cross-sectional study enrolled 217 hemodialysis patients across five centers in the West Bank between October and December 2025. A likely neuropathic pain component was defined as a PainDETECT score ≥ 19 . Pain-related disability and health-related quality of life were assessed using the Pain Disability Index (PDI) and EQ-5D-5L, respectively. Associations were evaluated using multivariable linear and logistic regression.

Results

A likely neuropathic pain component was identified in 22 participants (10.1%). Each 1-point increase in PainDETECT score was independently associated with lower EQ-5D-5L index values ($B = -0.035$, 95% CI -0.041 to -0.029 ; $p < 0.001$) and lower EQ-VAS scores ($B = -1.171$, 95% CI -1.542 to -0.801 ; $p < 0.001$), but paradoxically with lower PDI scores ($B = -0.417$, 95% CI -0.725 to -0.109 ; $p = 0.008$). Hemodialysis duration > 5 years was independently associated with more than fivefold higher odds of a likely neuropathic pain component (adjusted OR = 5.558, 95% CI 1.903–16.235; $p = 0.002$), while diabetes mellitus showed no independent association.

Conclusions

A likely neuropathic pain component was identified in approximately 1 in 10 hemodialysis patients in the West Bank. Higher PainDETECT scores were independently associated with poorer health-related quality of life, while hemodialysis duration > 5 years was associated with higher odds of a likely neuropathic pain component.

Introduction

Chronic kidney disease (CKD) is defined by markers of kidney damage or an estimated glomerular filtration rate (eGFR) of less than 60 mL/min/1.73 m², persisting for at least three months. Advanced CKD may progress to kidney failure requiring kidney replacement therapy, with hemodialysis being the

most commonly used modality in many settings (1, 2). Although chronic kidney disease and dialysis care have received increasing clinical attention, patients continue to experience a substantial and often undertreated burden of disease-related symptoms, associated with reduced physical functioning, poorer psychological well-being, and diminished quality of life (3–6).

Pain is one of the most common and distressing symptoms among patients receiving hemodialysis, with the reported prevalence of chronic pain ranging from 33% to 82% (4). This pain is heterogeneous, spanning nociceptive, ischemic, musculoskeletal, and neuropathic mechanisms, with neuropathic pain accounting for roughly 10% of cases (3). Neuropathic pain is defined as pain arising directly from a lesion or disease affecting the somatosensory nervous system, distinguishing it from nociceptive pain caused by tissue injury; it is frequently refractory to conventional analgesics (6). Several mechanisms may contribute to neuropathic symptoms in hemodialysis patients, including uremic neuropathy, diabetes mellitus, chronic metabolic disturbances, vitamin deficiencies, and cumulative exposure to kidney failure–related complications (5–7). Neuropathic symptoms in hemodialysis patients may include burning, tingling, electric-shock-like pain, allodynia, thermal sensitivity, and numbness. Persistent neuropathic pain restricts mobility and daily activities, disturbs sleep, limits social participation, and contributes to psychological distress, collectively worsening health-related quality of life (7–9).

Pain in hemodialysis rarely occurs in isolation, it commonly coexists with fatigue, sleep disturbance, mood symptoms, and functional limitations, and greater cumulative symptom burden is associated with poorer physical and mental health-related quality of life (10, 11). Nevertheless, symptom management often remains secondary to biochemical targets and survival outcomes in routine nephrology care, and a substantial discordance persists between the symptoms patients prioritize and those addressed by their providers (12, 13). A patient-centered assessment of neuropathic features, functional interference, and quality of life is therefore essential for capturing pain's real-world impact and guiding individualized management (7, 12).

Despite the clinical importance of neuropathic pain, evidence among hemodialysis populations remains limited, and prevalence estimates vary considerably across studies. Regional data are similarly uneven: existing Middle Eastern dialysis research, including studies from Palestine, has generally assessed general health-related quality of life rather than neuropathic pain specifically, leaving this dimension largely unexamined in the region (3, 4, 14). Accordingly, this multicenter cross-sectional study aimed to estimate the prevalence of a likely neuropathic pain component among hemodialysis patients in the West Bank using the validated Arabic version of PainDETECT questionnaire (15). Secondary aims were to describe pain-related disability and health-related quality of life using the PDI and EQ-5D-5L, respectively, and to explore demographic, clinical, and laboratory factors associated with these outcomes.

Methods

Study design and setting

A multicenter analytical cross-sectional study was conducted to estimate the prevalence of a likely neuropathic pain component and to assess pain-related disability and health-related quality of life among adults receiving maintenance hemodialysis in the West Bank. The study was conducted at five facilities with hemodialysis units: An-Najah National University Hospital and the British Medical Center in Nablus, Thabet Thabet Governmental Hospital in Tulkarm, Palestine Medical Complex in Ramallah, and Darwish Nazzal Governmental Hospital in Qalqilya. Data were collected from October through December 2025.

Participants, recruitment, and sample size

Patients were eligible if they were aged 18 years or older and had received hemodialysis for more than three months. Exclusion criteria were a current or previous kidney transplant, previous peritoneal dialysis, cognitive or mental impairment that prevented reliable participation, refusal to participate, and a history of neurological disease or neurological surgery associated with neuropathy. Eligible patients attending participating centers during the study period were invited using convenience sampling. Written informed consent was obtained from all participants after the study was explained to them. Questionnaires were administered by investigators via face-to-face interviews.

Based on an anticipated neuropathic pain prevalence of 10% among hemodialysis patients (3), a 95% confidence level, and a 5% margin of error, the minimum required sample size was estimated as 139 participants using Cochran's formula (21), $n = Z^2P(1 - P)/d^2$. The final analytical sample ($N = 217$) exceeded this minimum.

Variables

The primary outcome was a likely neuropathic pain component, defined as a PainDETECT score ≥ 19 with a $> 90\%$ predictive probability (16). Secondary outcomes were the continuous PainDETECT score, total PDI score, EQ-5D-5L index value, EQ-VAS score, and responses within each EQ-5D-5L dimension. Explanatory variables included age, sex, residence type, educational level, employment status, smoking status, hemodialysis duration, hypertension, and diabetes mellitus, as well as laboratory measures, including hemoglobin, ferritin, parathyroid hormone, calcium, phosphorus, and albumin.

Continuous variables included age, hemodialysis duration, PainDETECT score, PDI score, EQ-5D-5L index value, EQ-VAS score, and laboratory measurements. Age was retained as a continuous variable in the primary multivariable models and categorized as < 60 versus ≥ 60 years only in exploratory unadjusted analyses. Hemodialysis duration was categorized as > 5 versus ≤ 5 years in the adjusted models. PainDETECT score was analyzed both as a continuous exposure in linear regression models and categorized into three classification groups for the primary outcome and unadjusted comparisons: unlikely (≤ 12), uncertain (13–18), and likely (≥ 19) to have a neuropathic pain component (16). Other

continuous variables were summarized using the mean $\pm$ standard deviation or median [interquartile range], according to their distribution.

Study instruments

PainDETECT is a validated screening questionnaire designed to identify a possible neuropathic component of pain (16). An Arabic-language version has demonstrated good test-retest reliability and acceptable diagnostic discrimination in patients with chronic pain (15). The final PainDETECT score incorporates seven sensory-symptom items, one pain-course pattern item, and one pain-radiation item. Scores ≤ 12 indicate that a neuropathic component is unlikely, scores of 13–18 are considered ambiguous, and scores ≥ 19 indicate that a neuropathic component is likely (16). PainDETECT was treated as a screening measure rather than a clinical diagnosis.

The PDI is a validated seven-item instrument that measures pain-related disability across family and home responsibilities, recreation, social activity, occupation, sexual behavior, self-care, and life-support activities (17). Each item is rated from 0 (no disability) to 10 (total disability), yielding a total score of 0–70, with higher scores indicating greater disability. The PDI was analyzed as a continuous score. The PDI was translated into Arabic by the research team using a forward–backward translation procedure, and the translated version was reviewed by clinical experts for content and face validity. The translated instrument was then pilot-tested with 10 participants to assess clarity and comprehension; these pilot participants were not included in the final analytic sample.

The EQ-5D-5L is a standardized generic measure of health-related quality of life that assesses mobility, self-care, usual activities, pain/discomfort, and anxiety/depression at five severity levels (18). It also includes the EQ-VAS, on which respondents rate their current health from 0 (worst imaginable health) to 100 (best imaginable health) (19). The five-dimensional health state was converted to an EQ-5D-5L index value (19). Arabic-language EQ-5D-5L versions have demonstrated acceptable psychometric properties in Arabic-speaking populations (20). Sociodemographic and clinical data were collected during the interview, and laboratory variables were obtained from medical records with participant permission.

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of An-Najah National University; IRB reference number (Med.Oct.2025/48). Participation was entirely voluntary and anonymous. Written informed consent was obtained from all participants prior to participation, and no personally identifiable information was collected.

Statistical analysis

Analyses were performed using IBM SPSS Statistics version 27. Continuous variables were summarized using mean $\pm$ standard deviation or median [interquartile range], and categorical variables were

summarized using frequencies and percentages. Unadjusted comparisons across the three PainDETECT classification groups were conducted using the Kruskal–Wallis H test. Separate multivariable linear regression models were fitted for the PDI, EQ-5D-5L index, and EQ-VAS outcomes, with continuous PainDETECT score as the exposure and adjustment for age, sex, diabetes mellitus, and hemodialysis duration > 5 years. A multivariable binary logistic regression model was fitted with a PainDETECT score ≥ 19 as the outcome and age, sex, diabetes mellitus, and hemodialysis duration > 5 years as covariates; an expanded logistic model additionally adjusting for residence, smoking status, and educational level is reported in the supplementary material. Adjusted odds ratios (ORs), unstandardized regression coefficients (B), 95% confidence intervals (CIs), and p values were reported. Primary multivariable analyses used complete cases ($n = 202$). A two-sided p value < 0.05 was considered statistically significant.

Results

Participant recruitment and demographic characteristics

A total of 292 patients were recruited across the five participating centers, of whom 75 were excluded: 52 for prior surgery or neurological disease associated with neuropathy, 14 for a history of kidney transplant, and 9 for peritoneal dialysis. The final analytical sample comprised 217 participants (Figure 1).

Clinical and laboratory characteristics

The mean age was 59.55 ± 13.91 years; 126 participants (58.1%) were aged ≥ 60 years, and 71 (32.7%) were female. Most participants lived in villages (53.0%), were unemployed (57.3%), and had no formal education (53.9%) (Table 1).

Hypertension was present in 169 participants (77.9%) and diabetes mellitus in 107 (49.3%). The median hemodialysis duration was 36.00 months [IQR, 14.00–72.00]. Median ferritin, parathyroid hormone, and phosphorus levels were 657.82 ng/mL [IQR, 417.75–1001.18], 379.55 pg/mL [IQR, 198.08–699.00], and 4.60 mg/dL [IQR, 3.80–5.80], respectively. Mean hemoglobin, calcium, and albumin levels were 10.63 ± 1.69 g/dL, 8.64 ± 1.01 mg/dL, and 3.83 ± 0.46 g/dL, respectively (Table 1).

Pain characteristics, disability, and health-related quality of life

Pain characteristics, pain-related disability, and health-related quality of life are summarized in Table 2. The median PainDETECT score was 7.00 [IQR, 2.00–14.00], and the median PDI score was 34.00 [IQR, 21.00–43.00]. A neuropathic component was classified as unlikely in 153 participants (70.5%), uncertain in 42 (19.4%), and likely in 22 (10.1%). Lower-extremity pain was the most frequently reported pain location (43.5%), while 91.2% reported no pain radiation. The median EQ-5D-5L index value was 0.49 [IQR, 0.14–0.73], and the median EQ-VAS score was 60 [IQR, 50–70]. Pain/discomfort was the most frequently affected EQ-5D-5L dimension (73.3%), followed by anxiety/depression (65.9%), usual activities (59.9%), mobility (56.6%), and self-care (34.6%) (Table 2; Figures 2 and 3).

Pain-related disability and quality of life according to painDETECT classification

Pain-related disability and health-related quality of life differed across PainDETECT classifications (Table 3, Panel A). Median PDI scores were 37.00 [IQR, 24.00–45.50] in the unlikely group, 24.00 [IQR, 13.75–38.00] in the uncertain group, and 31.50 [IQR, 14.75–41.50] in the likely group ($p=0.002$). Median EQ-5D-5L index and EQ-VAS scores were substantially lower in the uncertain and likely groups than in the unlikely group (both $p<0.001$). In adjusted linear regression, each 1-point increase in PainDETECT score was associated with a 0.417-point lower PDI score ($B=-0.417$, 95% CI -0.725 to -0.109 ; $p=0.008$), a 0.035-point lower EQ-5D-5L index value ($B=-0.035$, 95% CI -0.041 to -0.029 ; $p<0.001$), and a 1.171-point lower EQ-VAS score ($B=-1.171$, 95% CI -1.542 to -0.801 ; $p<0.001$) after adjustment for age, sex, diabetes mellitus, and hemodialysis duration >5 years (Table 3, Panel B).

Factors associated with a likely neuropathic pain component

In the primary multivariable logistic regression model, which included 202 complete cases and 20 outcome events, hemodialysis duration >5 years was independently associated with a likely neuropathic pain component (adjusted OR=5.558, 95% CI 1.903–16.235; $p=0.002$) (Table 4 and Figure 4). Age showed a nonsignificant inverse association per 1-year increase (adjusted OR=0.962, 95% CI 0.922–1.003; $p=0.068$), and male sex showed a nonsignificant tendency toward lower odds than female sex (adjusted OR=0.403, 95% CI 0.151–1.078; $p=0.070$). Diabetes mellitus was not independently associated with the outcome (adjusted OR=2.029, 95% CI 0.714–5.767; $p=0.184$).

Additional findings

Exploratory unadjusted analyses showed higher PainDETECT scores among women, participants with diabetes mellitus, camp residents, non-smokers, and participants with no formal education. PDI scores differed significantly by age and sex only, while lower EQ-5D-5L index values were observed among older participants, women, participants with diabetes mellitus, camp residents, non-smokers, and participants with no formal education (Additional file 1: Supplementary Table S1). In the expanded multivariable logistic regression model additionally adjusting for residence, smoking status, and educational level (Additional file 1: Supplementary Table S2), hemodialysis duration >5 years remained the only variable independently associated with a likely neuropathic pain component (adjusted OR=5.395, 95% CI 1.808–16.100; $p=0.003$), with no other covariate reaching significance. Full multivariable linear regression models simultaneously adjusting for PainDETECT score, age, sex, diabetes mellitus, and hemodialysis duration (Additional file 1: Supplementary Table S3) confirmed that higher PainDETECT score remained independently associated with lower PDI, EQ-5D-5L index, and EQ-VAS values (all $p\leq 0.008$), while older age was independently associated with lower EQ-5D-5L index and EQ-VAS scores, male sex with higher EQ-5D-5L index values, and neither diabetes mellitus nor hemodialysis duration >5 years retained an independent association with any outcome once PainDETECT score was included.

Discussion

This multicenter study characterized the prevalence of a likely neuropathic pain component and its relationship with pain-related disability and health-related quality of life among hemodialysis patients in the West Bank. A likely neuropathic pain component was identified in 10.1% of participants, pain/discomfort was the most frequently reported health problem, and higher PainDETECT scores were independently associated with poorer health-related quality of life. Hemodialysis duration exceeding 5 years was the only factor independently associated with a positive screen, in both the primary and expanded adjusted models.

The prevalence of a likely neuropathic pain component in our study (10.1%) lies at the lower end of previously reported neuropathic pain estimates in dialysis populations, which have ranged from a pooled prevalence of 10% in a meta-analysis of chronic kidney disease patients (3), to 22.1% among pain diagnoses classified using the IASP pathophysiological framework (8), 30.2% using the Douleur Neuropathique 4 questionnaire (5), and 51.4% using the Neuropathic Pain Questionnaire (7), reflecting substantial variation according to case definition, population characteristics, and assessment method.

Pain-related disability differed significantly across PainDETECT categories but was not monotonic: median PDI scores were highest in the unlikely group and lowest in the uncertain group, and the adjusted model similarly showed higher PainDETECT scores associated with lower PDI scores. This direction is unexpected because higher PDI values conventionally indicate greater pain-related disability (17), and neuropathic pain has generally been associated with greater functional impairment and poorer quality of life in comparable dialysis populations (5, 7). Several non-mutually-exclusive explanations merit consideration. First, the uncertain ($n = 42$) and likely ($n = 22$) subgroups were considerably smaller than the unlikely subgroup ($n = 153$), and the wide, overlapping PDI interquartile ranges suggest substantial within-group heterogeneity, so the non-monotonic pattern may partly reflect sampling variability rather than a stable population-level relationship. Second, residual confounding cannot be excluded, as the adjusted model did not capture pain duration, analgesic use, comorbidity burden, or baseline functional status. Third, and perhaps most importantly, the PDI captures broad functional interference across seven life domains, whereas PainDETECT specifically screens for the sensory qualities of neuropathic pain (16), without directly quantifying overall pain severity. Patients classified as unlikely to have a neuropathic component may nonetheless experience severe nociceptive or musculoskeletal pain, such as that from osteoarthritis or peripheral vascular disease, both common in hemodialysis populations (8), which can drive disability independent of neuropathic symptom burden. This is consistent with evidence that nociceptive pain predominates among diagnosed chronic pain syndromes in this population (8), and that pain is often of mixed origin (5). Given the modest subgroup sizes and exploratory nature of this analysis, this inverse association should be regarded as hypothesis-generating until replicated in larger samples using instruments capable of distinguishing neuropathic from nociceptive contributions to disability.

Health-related quality of life was substantially affected. Pain/discomfort was the most frequently reported EQ-5D-5L problem, followed by anxiety/depression and limitations in usual activities. The median EQ-5D-5L index value was 0.49 and the median EQ-VAS score was 60, figures that are broadly

consistent with, though somewhat higher than, those reported in earlier Palestinian dialysis cohorts: Zyoud et al reported a mean EQ-5D index of 0.37 among hemodialysis patients in the West Bank (22), and Khatib et al reported a still lower mean index of 0.314 and mean EQ-VAS of 50.85 among diabetic hemodialysis patients specifically (14), a population expected to carry a heavier symptom and comorbidity burden. In contrast to the PDI finding, the associations between PainDETECT and both quality-of-life measures were consistent and graded: each 1-point increase in PainDETECT score was associated with a 0.035-point reduction in the EQ-5D-5L index and a 1.171-point reduction in EQ-VAS after adjustment. This pattern aligns closely with findings from Ergül et al, who reported a strong negative correlation between neuropathic pain screening scores and quality of life in Turkish hemodialysis patients ($r = -0.809$, $p < 0.001$), with significantly poorer scores across all quality-of-life subdomains among those screening positive for neuropathic pain (7). Similarly, Kitala-Tańska et al found that Polish dialysis patients with a probable neuropathic component reported significantly lower life satisfaction than those with non-neuropathic chronic pain or no pain at all (5). Taken together, these findings support the clinical relevance of neuropathic pain features to patients' perceived health and reinforce a consistent, cross-national pattern linking neuropathic pain specifically, rather than chronic pain in general, to disproportionately poorer health-related quality of life in dialysis populations.

Hemodialysis duration > 5 years was associated with more than fivefold higher adjusted odds of a likely neuropathic pain component (adjusted OR = 5.558, 95% CI 1.903–16.235). This aligns with Ergül et al, who reported markedly higher neuropathic pain prevalence among patients dialyzed for more than 7 years (69.2%; $p = 0.004$) (7), though Kitala-Tańska et al found no such association in a Polish cohort, highlighting inconsistency across populations possibly attributable to differences in case definition and comorbidity profile (5). A cumulative burden of uremic neurotoxicity offers a plausible mechanism: prolonged renal failure is associated with progressive accumulation of neurotoxic solutes and micronutrient deficiencies that contribute to axonal degeneration and demyelination (5), while hyperparathyroidism and hyperkalemia, both more prevalent with longer dialysis exposure, have also been implicated (5, 23).

Diabetes mellitus showed no independent association with a likely neuropathic pain component (OR = 2.029, $p = 0.184$), despite being the most commonly identified cause of neuropathic pain in comparable dialysis cohorts (5, 6), likely reflecting limited power (20 outcome events). In exploratory unadjusted analyses, camp residents had higher PainDETECT scores and lower EQ-5D-5L index values than participants living in cities or village, a disparity exceeding sex- or diabetes-related differences and unreported elsewhere in the literature (5, 7, 8). However, the camp subgroup was small ($n = 15$), therefore, these findings should be interpreted cautiously. The predominance of lower-extremity pain (43.5%) with minimal radiation (91.2% reporting none) is consistent with the distal, symmetric pattern of uremic polyneuropathy (24).

Strengths and limitations

This study has several strengths. To our knowledge, it is among the first to estimate the prevalence of a likely neuropathic pain component specifically among hemodialysis patients in the West Bank, addressing a notable regional gap, as prior Palestinian dialysis studies have assessed general quality of life without a dedicated neuropathic pain screening instrument. Recruitment from five centers across four governorates improved geographic coverage, and standardized questionnaires and interviewer procedures limited measurement variability across sites. In the absence of a validated Arabic PDI, the instrument underwent forward–backward translation, expert review, and pilot testing, supporting its content and face validity. Finally, the multidimensional assessment, combining a neuropathic pain screening tool, a disability index, and a generic quality-of-life measure, captured pain's real-world impact from complementary perspectives rather than through prevalence alone.

Several limitations should be acknowledged. The cross-sectional design precludes causal or temporal inference, including for the association between hemodialysis duration and neuropathic pain. Convenience sampling may limit generalizability, and although recall bias was minimized by focusing on current symptoms and medical-record data, residual confounding cannot be excluded, as pain duration, analgesic use, comorbidity burden, and baseline functional status were not captured. The primary outcome relied on a validated screening questionnaire, originally developed in chronic back pain patients, rather than neurological examination or specialist diagnosis, so the 10.1% figure reflects a screening-defined rather than clinically confirmed prevalence. The primary logistic model included only 20 outcome events across four covariates, limiting precision, and both the expanded supplementary model and the unexpected inverse PainDETECT–PDI association should be considered exploratory and hypothesis-generating given the modest subgroup sizes. Finally, the Arabic PDI translation followed a structured adaptation process but has not undergone full psychometric validation.

Future research should employ larger, longitudinal cohorts with confirmatory neurodiagnostic testing to clarify causal direction and separate the effects of neuropathic and nociceptive pain on disability.

Conclusion

In this multicenter study of hemodialysis patients in the West Bank, a likely neuropathic pain component was identified in 10.1% of participants and was independently associated with longer hemodialysis duration and with lower health-related quality of life, despite an unexpected inverse relationship with pain-related disability that warrants further investigation. These findings highlight the underrecognized burden of neuropathic pain in this population and support incorporating routine, patient-centered neuropathic pain screening into hemodialysis care to guide more individualized pain management.

Abbreviations

CI: Confidence Interval

CKD: Chronic Kidney Disease

eGFR: Estimated Glomerular Filtration Rate

EQ-5D-5L: EuroQol 5-Dimension 5-Level

EQ-VAS: EuroQol Visual Analogue Scale

IQR: Interquartile Range

OR: Odds Ratio

PDI: Pain Disability Index

SD: Standard Deviation

Declarations

Ethics approval: The study protocol was approved by the Institutional Review Board (IRB) of An-Najah National University (Med.Oct.2025/48). The data collection was approved by the five data collection sites. The research adhered to the principles of the Declaration of Helsinki. The patient information used in the study remained confidential and was used for the sole purpose of this research study.

Consent for publication: not applicable.

Clinical trial number: not applicable.

Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests: The authors declare that they have no competing interests.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author contributions: MA and MH conceived and designed the study, established the overall research framework, and provided supervision throughout its conduct. MS, QS, and AA were responsible for participant recruitment and data collection across the study sites. AQ performed the statistical analysis and interpretation of the data. AQ and DM prepared the initial draft of the manuscript, including the literature synthesis and presentation of results. MH, and MA critically revised the manuscript for important intellectual content and provided input on the interpretation of findings. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Acknowledgements: The authors thank An-Najah National University for providing the academic resources and research environment necessary to complete this study. We also gratefully acknowledge the staff of An-Najah National University Hospital and the British Medical Center in Nablus, Thabet Thabet Governmental Hospital in Tulkarm, Palestine Medical Complex in Ramallah, and Darwish Nazzal Governmental Hospital in Qalqilya for their cooperation and assistance in accessing patient data and supporting the research process. The authors used a digital English language editing tool to improve the clarity and readability of the manuscript. All content was reviewed, validated, and approved by the authors.

References

1. Stevens PE, Ahmed SB, Carrero JJ, Foster B, Francis A, Hall RK et al. KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. *Kidney International*. 2024;KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease105(4, Supplement):S117–314. 10.1016/j.kint.2023.10.018
2. Vaidya SR, Aeddula NR. Chronic Kidney Disease. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 [cited 2026 Aug 5]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK535404/> PubMed PMID: 30571025.
3. Lambourg E, Colvin L, Guthrie G, Murugan K, Lim M, Walker H, et al. The prevalence of pain among patients with chronic kidney disease using systematic review and meta-analysis. *Kidney Int*. 2021;100(3):636–49. 10.1016/j.kint.2021.03.041.
4. Brkovic T, Burilovic E, Puljak L. Prevalence and severity of pain in adult end-stage renal disease patients on chronic intermittent hemodialysis: a systematic review. *Patient Prefer Adherence*. 2016;10:1131–50. 10.2147. /PPA.S103927 PubMed PMID: 27382261; PubMed Central PMCID: PMC4922783.
5. Kitala-Tańska K, Kania-Zimnicka E, Tański D, Kwella N, Stompór T, Stompór M. Prevalence and Management of Chronic Pain, Including Neuropathic Pain, in Dialysis Patients with End-Stage Renal Disease. *Med Sci Monit*. 2024;30:e943808. 10.12659/MSM.943808 . PubMed PMID: 38751083; PubMed Central PMCID: PMC11107387.
6. Raouf M, Bettinger J, Wegrzyn EW, Mathew RO, Fudin JJ. Pharmacotherapeutic Management of Neuropathic Pain in End-Stage Renal Disease. *Kidney Dis (Basel)*. 2020;6(3):157–67. doi:10.1159/000504299 PubMed PMID: 32523958; PubMed Central PMCID: PMC7265715.
7. Ergül EE, Ayçiçek HB, Hayme S, Ergül Ç, Özdemir EC, Kara AV. Neuropathic Pain, Polyneuropathy, and Quality of Life in Patients Receiving Dialysis. *Med Sci Monit*. 2025;31. 10.12659/MSM.951360.
8. Schweiger V, Cacciapuoti M, Nizzero M, Simari S, Lombardi G, Gottin L, et al. Exploring Chronic Pain in Hemodialysis Patients: An Observational Study Based on the New IASP Classification for ICD-11. *Pain Ther*. 2025;14(1):375–85. 10.1007/s40122-024-00698-z . PubMed PMID: 39755882; PubMed Central PMCID: PMC11751259.

9. Coluzzi F. Assessing and Treating Chronic Pain in Patients with End-Stage Renal Disease. *Drugs*. 2018;78(14):1459–79. 10.1007/s40265-018-0980-9.
10. Weisbord SD, Fried LF, Arnold RM, Fine MJ, Levenson DJ, Peterson RA, et al. Prevalence, Severity, and Importance of Physical and Emotional Symptoms in Chronic Hemodialysis Patients. *J Am Soc Nephrol*. 2005;16(8):2487–94. 10.1681/ASN.2005020157.
11. Davison SN, Jhangri GS. Impact of pain and symptom burden on the health-related quality of life of hemodialysis patients. *J Pain Symptom Manage*. 2010;39(3):477–85. 10.1016/j.jpainsymman.2009.08.008 PubMed PMID: 20303025.
12. Mehrotra R, Davison SN, Farrington K, Flythe JE, Foo M, Madero M et al. Managing the symptom burden associated with maintenance dialysis: conclusions from a Kidney Disease: Improving Global Outcomes (KDIGO) Controversies Conference. *Kidney International*. 2023;104(3):441–54. 10.1016/j.kint.2023.05.019
13. Flythe JE, Hilliard T, Castillo G, Ikeler K, Orazi J, Abdel-Rahman E, et al. Symptom Prioritization among Adults Receiving In-Center Hemodialysis: A Mixed Methods Study. *Clin J Am Soc Nephrol*. 2018;13(5):735–45. 10.2215/CJN.10850917 . PubMed PMID: 29559445; PubMed Central PMCID: PMC5969481.
14. Khatib ST, Hemadneh MK, Hasan SA, Khazneh E, Zyoud SH. Quality of life in hemodialysis diabetic patients: a multicenter cross-sectional study from Palestine. *BMC Nephrol*. 2018;19(1):49. 10.1186/s12882-018-0849-x.
15. Abu-Shaheen A, Yousef S, Riaz M, Nofal A, AlFayyad I, Khan S, et al. Testing the validity and reliability of the Arabic version of the painDETECT questionnaire in the assessment of neuropathic pain. *PLoS ONE*. 2018;13(4):e0194358. 10.1371/journal.pone.0194358 . PubMed PMID: 29684014; PubMed Central PMCID: PMC5912744.
16. Freynhagen R, Baron R, Gockel U, Tölle TR. painDETECT: a new screening questionnaire to identify neuropathic components in patients with back pain. *Curr Med Res Opin*. 2006;22(10):1911–20. 10.1185/030079906X132488 . PubMed PMID: 17022849.
17. Tait RC, Pollard CA, Margolis RB, Duckro PN, Krause SJ. The Pain Disability Index: psychometric and validity data. *Arch Phys Med Rehabil*. 1987;68(7):438–41. PubMed PMID: 3606368.
18. Herdman M, Gudex C, Lloyd A, Janssen M, Kind P, Parkin D, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Qual Life Res*. 2011;20(10):1727–36. 10.1007/s11136-011-9903-x . PubMed PMID: 21479777; PubMed Central PMCID: PMC3220807.
19. van Hout B, Janssen MF, Feng YS, Kohlmann T, Busschbach J, Golicki D, et al. Interim Scoring for the EQ-5D-5L: Mapping the EQ-5D-5L to EQ-5D-3L Value Sets. *Value Health*. 2012;15(5):708–15. 10.1016/j.jval.2012.02.008.
20. Shawky Abdelgawaad A, El-Sharkawi M, Sarhan AM, Hassanien MA, Aziz M. Validation of the arabic version of the EuroQol-5-dimension 5-level (EQ-5D-5 L) in patients with spinal degenerative diseases. *BMC Public Health*. 2024;24(1):1119. 10.1186/s12889-024-18367-3 . PubMed PMID: 38654180; PubMed Central PMCID: PMC11040803.

21. Cochran WG. Sampling Techniques. New York: Wiley.

22. Zyoud SH, Daraghmeh DN, Mezyed DO, Khdeir RL, Sawafta MN, Ayaseh NA, et al. Factors affecting quality of life in patients on haemodialysis: a cross-sectional study from Palestine. BMC Nephrol. 2016;17(1):44. 10.1186/s12882-016-0257-z.

23. Arnold R, Issar T, Krishnan AV, Pussell BA. Neurological complications in chronic kidney disease. JRSM Cardiovasc Disease. 2016;5:2048004016677687. 10.1177/2048004016677687.

24. de Camargo CR, Schoueri JHM, Alves B, da CA, Veiga GRL da, Fonseca FLA, Bacci MR. Uremic neuropathy: an overview of the current literature. Rev Assoc Med Bras (1992). 2019;65(2):281–6. 10.1590/1806-9282.65.2.281 PubMed PMID: 30892456.

Tables

Table 1. Sociodemographic, clinical, and laboratory characteristics of the study population

Characteristic	Overall (N=217)
Sociodemographic characteristics	
Age, years	59.55 ± 13.91
Age ≥60 years	126 (58.1)
Female sex	71 (32.7)
Residence	
City	87 (40.1)
Village	115 (53.0)
Camp	15 (6.9)
Smoking status	
Non-smoker	121 (55.8)
Former smoker	31 (14.2)
Current smoker	65 (30.0)
Pack-year smoking history, n=205	0.00 [0.00–30.00]
Employment status, n=211	
Employed	90 (42.7)
Unemployed	121 (57.3)
Educational level	
No formal education	117 (53.9)
Primary or secondary education	61 (28.1)
Higher education	39 (18.0)
Clinical characteristics	
Hemodialysis duration, months, n=202	36.00 [14.00–72.00]
Hypertension	169 (77.9)
Diabetes mellitus	107 (49.3)
Laboratory characteristics	
Hemoglobin, g/dL, n=216	10.63 ± 1.69
Ferritin, ng/mL, n=214	657.82 [417.75–1001.18]
Parathyroid hormone, pg/mL, n=212	379.55 [198.08–699.00]

Characteristic	Overall (N=217)
Calcium, mg/dL, n=214	8.64 ± 1.01
Phosphorus, mg/dL, n=214	4.60 [3.80–5.80]
Albumin, g/dL, n=215	3.83 ± 0.46

Data are presented as mean ± standard deviation, median [interquartile range], or n (%), as appropriate. Percentages may not sum to 100% due to rounding. "Camp" refers to residence in a Palestinian refugee camp. Sample sizes smaller than the overall cohort (N=217) reflect missing data for that variable; laboratory values were obtained from medical records and were unavailable for patients without a corresponding recent measurement. SD, standard deviation.

Table 2. Pain characteristics, pain-related disability, and health-related quality of life

Measure	Overall (N=217)
Pain and disability scores	
PainDETECT total score	7.00 [2.00–14.00]
Pain Disability Index total score	34.00 [21.00–43.00]
PainDETECT classification	
Neuropathic component unlikely (≤ 12)	153 (70.5)
Neuropathic component uncertain (13–18)	42 (19.4)
Neuropathic component likely (≥ 19)	22 (10.1)
Pain location, n=216	
No pain	75 (34.7)
Lower extremities	94 (43.5)
Upper extremities	20 (9.3)
Upper and lower extremities	14 (6.5)
Generalized pain	6 (2.8)
Neck	4 (1.9)
Back	3 (1.4)
Pain radiation, n=216	
No radiation	197 (91.2)
Back	13 (6.0)
Pelvis	2 (0.9)
Shoulders	2 (0.9)
Upper extremities	2 (0.9)
Health-related quality of life	
EQ-5D-5L index value	0.49 [0.14–0.73]
EQ-VAS score	60.00 [50.00–70.00]
EQ-5D-5L dimensions: any problems	
Mobility	123 (56.6)
Self-care	75 (34.6)
Usual activities	130 (59.9)

Measure	Overall (N=217)
Pain/discomfort	159 (73.3)
Anxiety/depression	143 (65.9)

Data are presented as median [IQR] or n (%).

EQ-5D-5L, EuroQol 5-Dimension 5-Level; EQ-VAS, EuroQol visual analogue scale; IQR, interquartile range; PDI, Pain Disability Index.

Table 3. Pain-related disability and health-related quality of life according to PainDETECT classification and score

Panel A. Unadjusted outcomes according to PainDETECT classification

PainDETECT classification	n	PDI, median [IQR]	EQ-5D-5L index, median [IQR]	EQ-VAS, median [IQR]
Unlikely (≤ 12)	153	37.00 [24.00–45.50]	0.656 [0.345–0.796]	70 [50–80]
Uncertain (13–18)	42	24.00 [13.75–38.00]	0.099 [–0.234–0.422]	50 [30–60]
Likely (≥ 19)	22	31.50 [14.75–41.50]	0.151 [–0.107–0.391]	50 [40–62.5]
P value		0.002	<0.001	<0.001

Panel B. Adjusted associations with continuous PainDETECT score

Exposure	PDI, B (95% CI)	P value	EQ-5D-5L, B (95% CI)	P value	EQ-VAS, B (95% CI)	P value
PainDETECT score, per 1-point increase	–0.417 (–0.725 to –0.109)	0.008	–0.035 (–0.041 to –0.029)	<.001	–1.171 (–1.542 to –0.801)	<.001

Panel A data are presented as median [IQR], and P values were calculated using the Kruskal–Wallis H test. Panel B values are unstandardized regression coefficients (B) with 95% CIs from separate linear regression models adjusted for age, sex, diabetes mellitus, and hemodialysis duration >5 years; complete-case analysis included 202 participants.

Bold indicates $P < 0.05$.

CI, confidence interval; EQ-5D-5L, EuroQol 5-Dimension 5-Level; EQ-VAS, EuroQol visual analogue scale; IQR, interquartile range; PDI, Pain Disability Index.

Table 4. Factors associated with a likely neuropathic pain component

Variable contrast	Adjusted OR (95% CI)	P value
Age, per 1-year increase	0.962 (0.922–1.003)	0.068
Male vs female	0.403 (0.151–1.078)	0.070
Diabetes mellitus, yes vs no	2.029 (0.714–5.767)	0.184
Hemodialysis duration >5 years, yes vs no	5.558 (1.903–16.235)	0.002

The complete-case model included 202 participants, including 20 outcome events.

The outcome was a likely neuropathic pain component (PainDETECT ≥ 19). Bold indicates $P < 0.05$.

CI, confidence interval; OR, odds ratio

Figures

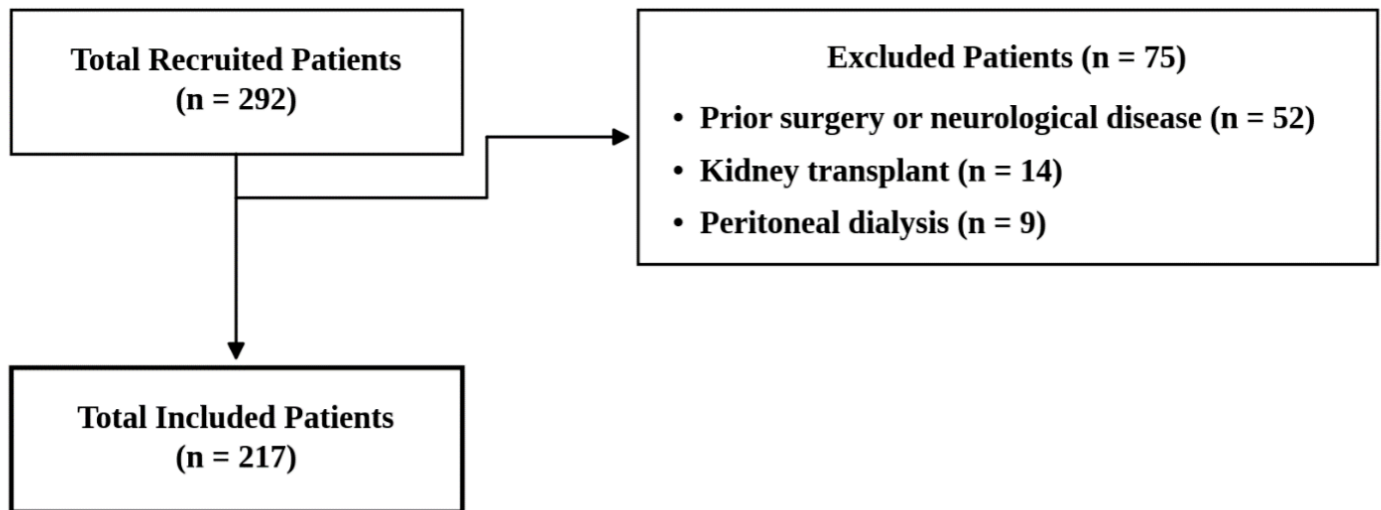


Figure 1

Flow diagram of patient recruitment and inclusion.

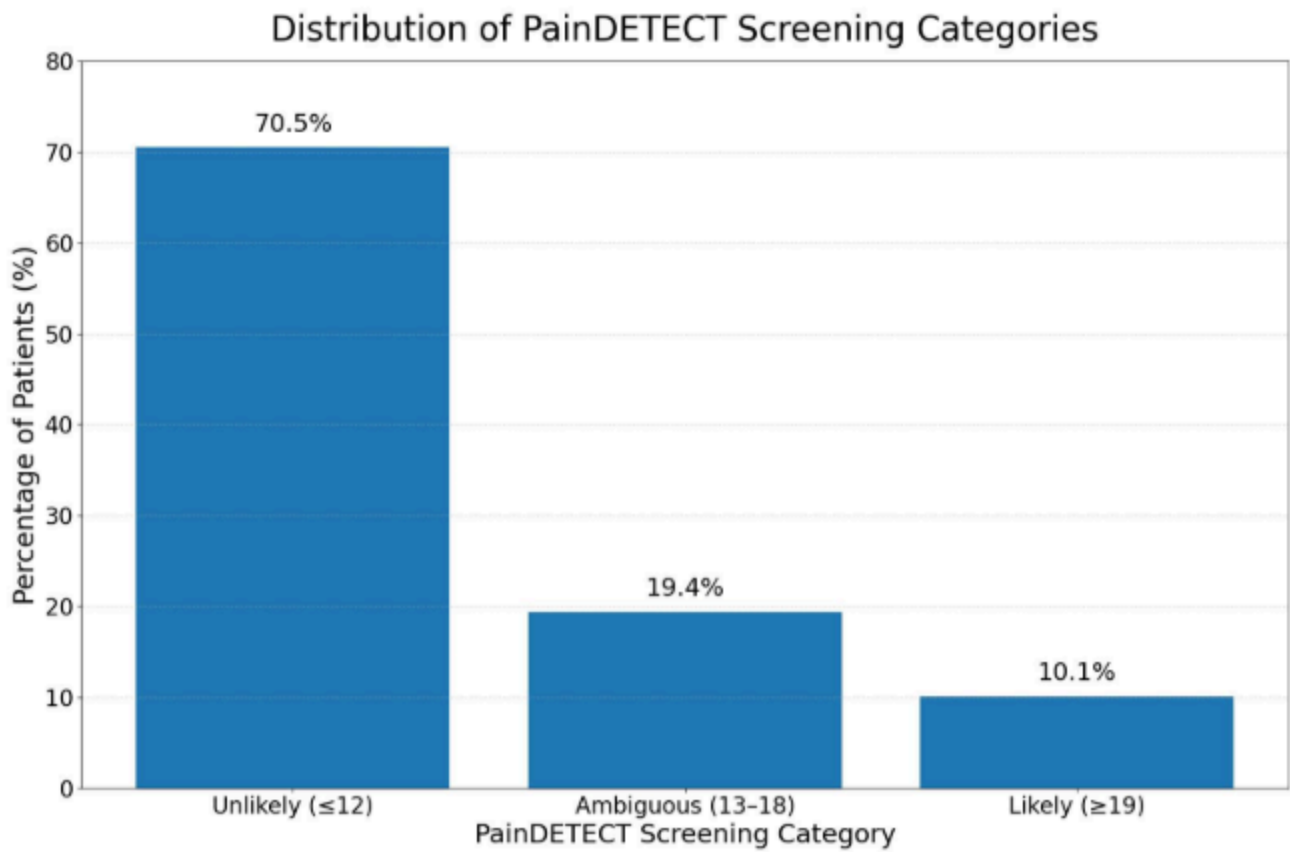


Figure 2
Distribution of PainDETECT screening categories among hemodialysis patients.

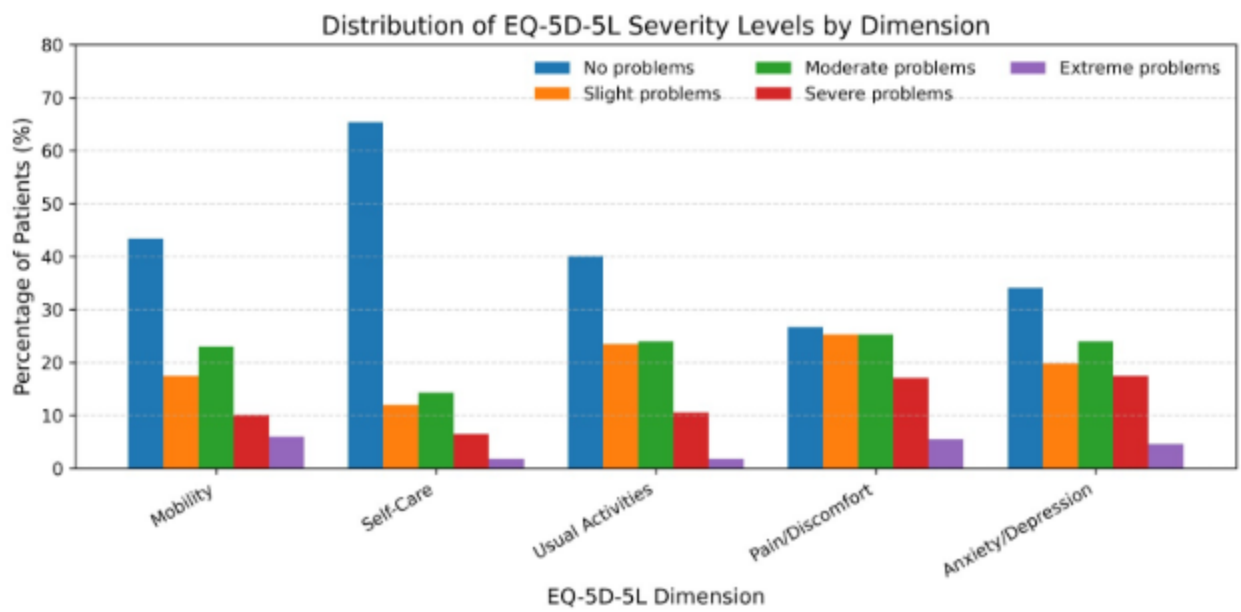


Figure 3
Distribution of EQ-5D-5L response levels across the five health dimensions.

Adjusted OR (95% CI)

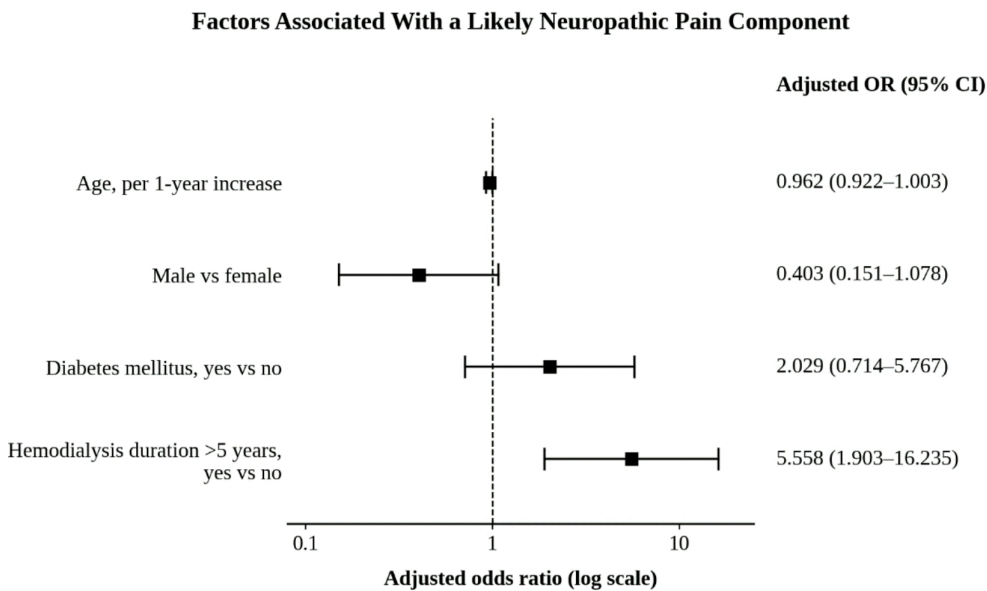
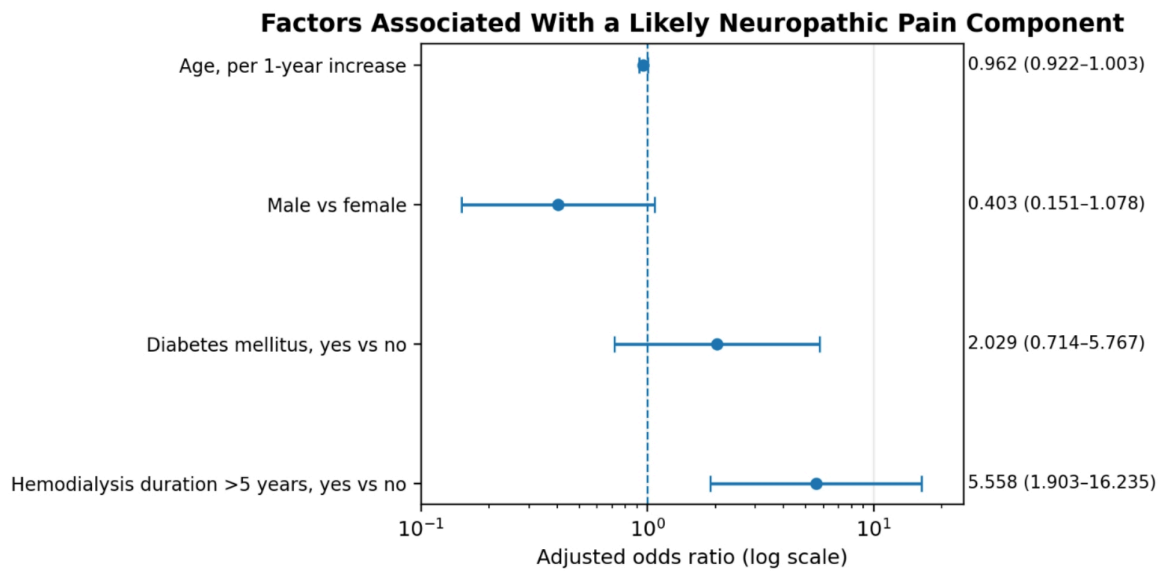


Figure 4

Adjusted odds ratios for factors associated with a likely neuropathic pain component (PainDETECT score ≥ 19).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [NeuropathicPainAdditionalfile1SupplementaryTablesS1S3..docx](#)