

Knowledge, attitudes, and practices regarding NSAID use and associated cardiovascular and renal risks among adults with hypertension in the West Bank, Palestine: a multicenter cross-sectional study

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Abstract

Background

Nonsteroidal anti-inflammatory drugs (NSAIDs) may worsen blood-pressure control and increase cardiovascular and renal risk, particularly among adults with hypertension. This study assessed knowledge, attitudes, and practices regarding NSAID use and its associated risks among adults with hypertension in the West Bank, Palestine.

Methods

A multicenter cross-sectional study was conducted between March and April 2026 among 384 adults with hypertension recruited from hospitals and primary healthcare centers. A study-specific questionnaire assessed sociodemographic and clinical characteristics, NSAID-use patterns, knowledge, attitudes, and self-reported practices. Group differences were examined using the Mann–Whitney U and Kruskal–Wallis tests, correlations using Spearman’s rank correlation coefficient, and associated factors using multivariable linear and logistic regression.

Results

The mean age was 58.2 ± 14.3 years, and 54.7% of participants were female. NSAID use within the previous 3 months was reported by 65.9%. Among 329 participants with a documented NSAID-use history, 44.7% obtained NSAIDs without a physician’s prescription. Awareness of renal harm was greater than awareness of cardiovascular harm: 76.0% recognized that long-term NSAID use may impair kidney function, whereas 47.7% recognized that NSAIDs may increase blood pressure, 27.3% recognized that they may impair blood-pressure control, and 25.3% recognized increased cardiovascular risk in people with hypertension or heart disease. Mean knowledge, attitude, and practice scores were 3.32 ± 1.78 out of 7, 2.80 ± 0.70 out of 5, and 4.9 ± 2.41 out of 10, respectively. Higher educational attainment and prescription-based acquisition were independently associated with higher knowledge scores. Prescription-based acquisition was also associated with greater odds of safe practice (adjusted odds ratio 2.21, 95% confidence interval 1.26–3.87). Higher attitude scores were inversely associated with safe practice.

Conclusions

NSAID exposure and nonprescription acquisition were common, while awareness of cardiovascular and blood-pressure-related risks was limited. Primary care and pharmacy encounters offer opportunities to identify NSAID use and provide targeted counseling on blood pressure, kidney risk, dosing, and

nonprescription use. Further research using validated measures is needed to clarify the relationship between stated attitudes and self-reported practices.

Introduction

Nonsteroidal anti-inflammatory drugs (NSAIDs) are among the most commonly used medications worldwide due to their analgesic, antipyretic, and anti-inflammatory properties. Because of their widespread availability, NSAIDs are used daily by more than 30 million individuals worldwide. In the United States, they represent nearly 60% of the over-the-counter analgesic market (1). They exert their therapeutic effects primarily through inhibition of cyclooxygenase (COX) enzymes, leading to reduced synthesis of prostaglandins involved in pain and inflammation. NSAIDs are broadly classified into non-selective COX inhibitors and selective COX-2 inhibitors, which differ in their efficacy and safety profiles depending on patient characteristics and clinical context.

Despite their effectiveness, NSAIDs are associated with important adverse effects, particularly among high-risk populations such as patients with cardiovascular and renal diseases. Renal complications include acute kidney injury, fluid and electrolyte disturbances, renal papillary necrosis, and drug-induced interstitial nephritis and nephrotic syndrome (2). In addition, NSAIDs may contribute to cardiovascular risk through renal hemodynamic effects and endothelial dysfunction, partly mediated by reduced prostaglandin synthesis and impaired nitric oxide activity, which may promote vasoconstriction, hypertension, and atherothrombotic events (3).

Hypertension is a major chronic condition characterized by persistently elevated blood pressure and is a leading risk factor for cardiovascular disease, stroke, and chronic kidney disease (4). Given that NSAIDs may elevate blood pressure and reduce the effectiveness of antihypertensive therapy(5), their use in hypertensive patients requires particular caution.

Despite the well-documented risks of NSAIDs, evidence suggests that patient awareness of their potential cardiovascular and renal adverse effects remains insufficient. This concern is particularly relevant among hypertensive individuals, who are at increased risk of NSAID-related complications. Furthermore, the easy accessibility of NSAIDs without prescription may contribute to unsupervised use and suboptimal safety practices. Although previous studies in different settings have reported inadequate knowledge and unsafe behaviors regarding NSAID use, there remains limited evidence from Palestine assessing knowledge, attitudes, and perceptions among hypertensive patients(6, 7). This gap limits the development of targeted educational and clinical interventions aimed at improving safe NSAID use in this high-risk population.

This study aimed to assess knowledge, attitudes, and practices regarding NSAID use and its associated cardiovascular and renal risks among adults with hypertension attending healthcare facilities in the West Bank, Palestine.

Methods

Study design and setting

This multicenter cross-sectional study was conducted between March and April 2026 among adults with hypertension attending selected hospitals and primary healthcare centers in the West Bank, Palestine. Recruitment sites included Yasser Arafat Hospital in Salfit; An-Najah National University Hospital, Al-Watani Hospital, Rafidia Governmental Hospital, and the Balata and Makhfeya primary healthcare centers in Nablus; Khalil Suleiman Governmental Hospital in Jenin; and Al-Makassed Islamic Charitable Hospital. These sites were selected to include participants from different healthcare settings and geographic areas of the West Bank.

Study population and eligibility criteria

Adults aged 18 years or older were eligible if they lived in the West Bank, reported a clinician diagnosis of hypertension or were currently using antihypertensive medication, could understand the questionnaire language, and provided informed consent. Participants were excluded if they did not meet the hypertension definition, were unable to provide informed consent or complete the questionnaire because of severe cognitive or communication impairment, or were critically ill or clinically unstable at recruitment. Questionnaires with more than 30% missing responses to key study items were excluded.

Sample size and technique

Based on an estimated adult population of approximately 2 million in the West Bank and a reported hypertension prevalence of 27.6%, the estimated hypertensive population was approximately 500,000–600,000 individuals (8, 9). Because no reliable local estimate of adequate NSAID-related knowledge was available, an expected proportion of 50% was used to provide the maximum required sample size. Using a 95% confidence level and a 5% margin of error, the minimum required sample was calculated as 384 participants using OpenEpi.

Participants were recruited using convenience sampling.

Data-collection procedures

Eligible participants received an explanation of the study objectives, procedures, confidentiality measures, and voluntary nature of participation before providing informed consent. Data were then collected using a structured questionnaire covering sociodemographic and clinical characteristics, NSAID-use patterns, knowledge of cardiovascular and renal risks, attitudes toward NSAID use, self-reported practices, and sources of medication information.

Measurement tool

Because no suitable validated instrument was identified for assessing NSAID-related knowledge, attitudes, and practices specifically among adults with hypertension, a study-specific questionnaire was developed based on the literature (10–12). The questionnaire was initially developed in English and translated into Arabic using a forward–backward translation procedure to ensure linguistic accuracy and conceptual equivalence. Content validity of the questionnaire was assessed through an expert review process involving specialists in clinical pharmacy, internal medicine, and biostatistics, who evaluated the relevance, clarity, and appropriateness of all items for measuring NSAID-related knowledge, attitudes, risk perception, and practices among hypertensive patients. A pilot study involving 10 participants was conducted to assess clarity, comprehension, and feasibility of the questionnaire, and minor wording modifications were incorporated based on participant feedback; pilot responses were not included in the final analysis. The questionnaire included sociodemographic and clinical characteristics (age, sex, region, educational level, duration of hypertension, comorbidities, and antihypertensive medication use), NSAID utilization patterns (frequency, indication, source of acquisition, and usage behavior), and three psychometric domains (knowledge, attitudes, and risk perception) in addition to a behavioral practice domain and sources of information.

Knowledge was assessed using 8 (true/false/“I don’t know”) items evaluating awareness of NSAID-related cardiovascular and renal risks. Attitudes toward NSAID use were measured using a 7-item Likert-scale domain combining two conceptually related item sets: four items assessing rejection of common safety misconceptions (e.g., the perceived safety of low-dose or short-term NSAID use) and three items assessing precautionary orientation (e.g., perceived need to understand NSAID effects on blood pressure, trust in healthcare professionals over non-medical sources, and willingness to avoid NSAIDs when blood pressure is uncontrolled). During data analysis, a reverse-scoring error affecting the three precautionary items was identified and corrected. Once corrected, the two item sets were found to be moderately correlated (Spearman’s $\rho = 0.42$) and to form a single internally consistent scale (Cronbach’s $\alpha = 0.736$), a substantial improvement over either item set’s reliability alone ($\alpha = 0.721$ and 0.553 , respectively). The final Attitude score was therefore computed as the mean of all seven items (range 1–5), with higher scores intended to indicate a more cautious, safety-oriented attitude. Accordingly, the study follows the classic three-domain Knowledge-Attitude-Practice structure rather than the originally planned four-domain structure.

NSAID-related practices were assessed using 7 behavioral items evaluating real-world medication use, including consultation with healthcare professionals, reading medication leaflets, self-medication behavior, dose modification, and disclosure of NSAID use. Finally, participants were asked about their primary sources of information regarding NSAIDs, including physicians, pharmacists, internet, social media, family or friends, or personal experience.

Internal consistency reliability of the questionnaire domains was evaluated using Cronbach’s alpha coefficients. The attitude domain was subsequently refined based on reliability analysis to improve scale

homogeneity before calculating the final attitude score used in subsequent analyses. Detailed reliability results, including Cronbach's alpha coefficients for all questionnaire domains, are presented in the Results section. Given the exploratory nature of the study and the absence of a standardized NSAID-specific tool for hypertensive patients, these reliability values were considered acceptable for preliminary scale development and population-based assessment.

Variable definitions

The study included three main outcome variables: knowledge, attitude, and practice related to NSAID use. The knowledge score was calculated as a summative index from 7 items assessing awareness of NSAID-associated cardiovascular and renal risks, each correct response contributing one point (range 0–7, higher indicating greater knowledge). An eighth item (“NSAIDs are safe for everyone because they are available without a prescription”) was excluded from the composite after item analysis showed a negative item-total correlation once correctly scored; it is instead reported as a standalone descriptive item. The attitude score was derived from the merged 7-item scale described above (range 1–5, higher indicating a more cautious attitude). The practice score was derived from 7 behavioral items assessing real-world NSAID-use behaviors, yielding a composite index ranging from 0 to 10, with higher scores indicating safer practices. For logistic regression analysis, the continuous practice score was dichotomized into safe practice (score ≥ 5 , coded 1) and unsafe practice (score ≤ 4 , coded 0), so that odds ratios above 1.0 directly indicate greater odds of safe practice.

Independent variables were classified into socio-demographic, medical history, utilization patterns, and information sourcing categories. Socio-demographic variables included age, collected as a continuous variable in years, sex, treated as a binary variable (male or female), governorate/region (north, central, south), and educational level, categorized into less than secondary school, secondary school, diploma/university, or postgraduate studies. Medical history variables comprised the duration since hypertension diagnosis, categorized as less than 1 year, 1 to 5 years, or more than 5 years, and current adherence to hypertension medication, treated as a binary variable (yes or no). Comorbidities were documented as separate binary variables (yes or no) for diabetes, kidney disease, heart failure, and previous heart attack/stroke.

NSAID utilization pattern variables encompassed the frequency of last NSAID use (within the past 3 months, more than 3 months ago, or never used) and the primary reason for discontinuation or continued use (experiencing NSAID-related complications, physician advice to discontinue use, influence of family, friends, or social media regarding potential harm, continued current use of NSAIDs, or never having used NSAIDs). Additional utilization attributes treated as categorical variables included the main source of obtaining the drugs (doctor's prescription or non-doctor's prescription), the most common clinical indication for use (headache, joint/back pain, toothache, cold/fever, or other), and the explicit usage frequency pattern (ranging from less than once per month to daily use). Finally, information source variables captured the primary origin of patients' knowledge regarding painkillers, categorized as doctor, pharmacist, internet, social media, family/friends, or personal experience.

Statistical analysis

Data were analyzed using IBM SPSS Statistics version 27. Categorical variables were summarized using frequencies and percentages, while continuous variables were summarized using means and standard deviations or medians and interquartile ranges, as appropriate. The distributions of the composite scores were assessed visually using histograms and Q–Q plots and analytically using the Shapiro–Wilk test. Because the score distributions deviated from normality, nonparametric tests were used for bivariate comparisons. Differences in scores between two groups were evaluated using the Mann–Whitney U test, while comparisons across three or more groups were performed using the Kruskal–Wallis test. Significant Kruskal–Wallis results were followed by pairwise comparisons with Bonferroni adjustment. Spearman’s rank correlation coefficient was used to evaluate associations between ordinal or non-normally distributed variables. Multivariable linear regression was used to identify factors associated with the continuous knowledge, attitude, and practice scores. Categorical predictors were entered using indicator variables with prespecified reference categories. As an exploratory secondary analysis, binary logistic regression was used to examine factors associated with safe practice, defined as a practice score of ≥ 5 . Complete-case analysis was used for each model. Model assumptions and multicollinearity were assessed using residual plots and variance inflation factors. Results are presented as unstandardized regression coefficients or adjusted odds ratios with 95% confidence intervals. A two-sided p value < 0.05 was considered statistically significant.

Use of generative AI tools

ChatGPT, developed by OpenAI, was used for language editing and improving manuscript clarity. All generated text was reviewed and revised by the authors. The tool was not used to generate, modify, or analyze the study data.

Results

Of the 384 participants, 329 had complete information on NSAID source, indication, and frequency of use. Complete data for calculating the Practice score were available for 337 participants. The denominator used for each analysis is reported in the relevant table.

Reliability and Internal Consistency

The final 7-item Knowledge scale showed acceptable internal consistency ($\alpha = 0.597$), the combined 7-item Attitude scale showed good reliability ($\alpha = 0.736$), and the 7-item Practice scale showed good reliability ($\alpha = 0.719$) (Table 1). The Attitude scale combines two conceptually related subscales misconception rejection and precaution/trust orientation which were found during analysis to be moderately correlated ($r = 0.42$) and to form a single coherent construct once a scoring error in the original subscale division was corrected.

Table 1
Internal consistency reliability of the study scales

Questionnaire Domain	Items	Cronbach's α
Knowledge scale (cardiovascular and renal risks)	7	0.597
Attitude scale (misconception rejection + precaution/trust, combined)	7	0.736
Practice scale (NSAID-use behaviors)	7	0.719

Sociodemographic Characteristics, NSAID Use Patterns, and Knowledge

A total of 384 hypertensive patients participated in the study. The mean age was 58.2 ± 14.3 years. Slightly more than half of participants were female (210, 54.7%), with the remainder male (174, 45.3%). Most participants resided in the Central region (236, 61.5%), followed by the North (141, 36.7%) and South (7, 1.8%). Educational attainment was distributed across four categories: secondary school was the most common level (151, 39.3%), followed by less than secondary education (92, 24.0%), university or diploma-level education (99, 25.8%), and postgraduate education (42, 10.9%).

Regarding disease duration, more than half of participants (216, 56.3%) had been diagnosed with hypertension for more than 5 years, 143 (37.2%) for 1–5 years, and 25 (6.5%) for less than 1 year. The large majority (367, 95.6%) were currently taking antihypertensive medication. Comorbidities were common: 162 participants (42.2%) had diabetes mellitus, 50 (13.0%) had kidney disease, 35 (9.1%) had heart failure, and 31 (8.1%) had a previous myocardial infarction or stroke. Overall, 153 participants (39.8%) reported no comorbidity or were unsure of having one, while 231 (60.2%) reported at least one. The sociodemographic and clinical characteristics of the participants are summarized in Table 2.

Table 2
Sociodemographic and clinical characteristics of hypertensive participants (N = 384)

Characteristic	Category	n	%
Age, years (mean $\pm$ SD)	—	58.2 $\pm$ 14.3	—
Sex	Female	210	54.7
	Male	174	45.3
Governorate / region	North	141	36.7
	Central	236	61.5
	South	7	1.8
Educational level	Less than secondary	92	24.0
	Secondary school	151	39.3
	University / diploma	99	25.8
	Postgraduate	42	10.9
Duration of hypertension, years	< 1	25	6.5
	1–5	143	37.2
	> 5	216	56.3
Currently taking antihypertensive medication	Yes	367	95.6
	No	17	4.4
Diabetes mellitus	Yes	162	42.2
	No	222	57.8
Kidney disease	Yes	50	13.0
	No	334	87.0
Heart failure	Yes	35	9.1
	No	349	90.9
Previous MI / stroke	Yes	31	8.1
	No	353	91.9
No comorbidity / unsure	Yes	153	39.8
	No	231	60.2

NSAID Use Patterns

Regarding recency of NSAID use, 253 participants (65.9%) reported use within the past 3 months, 80 (20.8%) reported use more than 3 months ago, and 51 (13.3%) reported never having used NSAIDs. On a related item asking about current status or reason for discontinuation, 258 participants (67.2%) reported still using NSAIDs, 64 (16.7%) had discontinued on physician advice, 15 (3.9%) had discontinued after being warned by family or friends, 7 (1.8%) had discontinued following a complication related to NSAID use, and 40 (10.4%) reported never having used NSAIDs. It is worth noting that this figure of 40 does not exactly match the 51 who reported "never used" on the recency item; 11 participants gave apparently inconsistent answers across these two related items, which could not be fully reconciled without access to the original completed questionnaires.

Among the 329 participants with a documented NSAID-use history, 182 (55.3%) obtained NSAIDs through a doctor's prescription, while 147 (44.7%) obtained them without a prescription (over-the-counter or self-directed use). Joint and back pain were the most common indication for use (198, 60.2%), followed by headache (80, 24.3%), toothache (26, 7.9%), and cold or fever (25, 7.6%). Regarding frequency of use, the most common pattern was 3–7 times per month (103, 31.3%), followed by 1–2 times per week (85, 25.8%), 1–2 times per month (66, 20.1%), 3–7 times per week (55, 16.7%), less than once per month (16, 4.9%), and daily use (4, 1.2%).

A separate item assessed a common misconception and was excluded from the composite Knowledge score: 212 participants (55.2%) incorrectly agreed that "NSAIDs are safe for everyone because they are available without a prescription," while 172 (44.8%) correctly disagreed. Participants' NSAID-use patterns are summarized in Table 3.

Table 3
Patterns of NSAID use among hypertensive patients (N = 384)

Characteristic	n	%
Timeframe of NSAID use		
Within the past 3 months	253	65.9
More than 3 months ago	80	20.8
Never used	51	13.3
Current status / reason for discontinuation *		
Still using NSAIDs	258	67.2
Doctor advised discontinuation	64	16.7
Advised by family/friends to stop	15	3.9
Discontinued due to NSAID-related complications	7	1.8
Never used NSAIDs	40	10.4
Medication sourcing pathway (n = 329)		
Doctor's prescription	182	55.3
Nonprescription/over-the-counter acquisition	147	44.7
Primary indication for use (n = 329)		
Joint / back pain	198	60.2
Headache	80	24.3
Toothache	26	7.9
Cold / fever	25	7.6
Frequency of consumption (n = 329)		
3–7 times per month	103	31.3
1–2 times per week	85	25.8
1–2 times per month	66	20.1
3–7 times per week	55	16.7
Less than once per month	16	4.9
*51 participants reported "never used" on the timeframe item, but only 40 gave the matching answer on this status item (11 gave logically inconsistent answers across the two related items). Responses to the NSAID-use timeframe and current-status items were inconsistent for 11 participants. The two variables were therefore analyzed and reported separate		

Characteristic	n	%
Daily	4	1.2
*51 participants reported "never used" on the timeframe item, but only 40 gave the matching answer on this status item (11 gave logically inconsistent answers across the two related items). Responses to the NSAID-use timeframe and current-status items were inconsistent for 11 participants. The two variables were therefore analyzed and reported separate		

Knowledge of Cardiovascular and Renal Risks

Regarding renal safety, 292 participants (76.0%) correctly recognized that long-term NSAID use may negatively affect kidney function, 209 (54.4%) correctly recognized that dehydration or low fluid intake increases the risk of acute kidney injury, and 154 (40.1%) correctly recognized that elderly patients and those with chronic disease are at higher renal risk. Awareness of cardiovascular effects was markedly lower: 183 participants (47.7%) recognized that NSAIDs may increase blood pressure, 105 (27.3%) recognized that NSAIDs may impair blood pressure control, and only 97 (25.3%) recognized that NSAIDs increase cardiovascular risk in patients with heart disease or hypertension. Regarding general medication-safety awareness, 234 participants (60.9%) correctly recognized that using multiple NSAIDs or switching between them increases risk.

A separate item assessed a common misconception and was excluded from the composite Knowledge score: 212 participants (55.2%) incorrectly agreed that "NSAIDs are safe for everyone because they are available without a prescription," while 172 (44.8%) correctly disagreed. All items are presented in Table 4 and Fig. 1.

Table 4
Knowledge of cardiovascular and renal risks associated with NSAID use (N = 384)

Knowledge item	Correct, n (%)	Mean (SD)
Renal safety and toxicity		
Long-term NSAID use may negatively affect kidney function	292 (76.0)	0.76 (0.427)
Dehydration / low fluid intake increases AKI risk	209 (54.4)	0.54 (0.499)
Elderly and chronic-disease patients are at higher risk	154 (40.1)	0.40 (0.491)
Cardiovascular effects		
NSAIDs may increase blood pressure	183 (47.7)	0.48 (0.500)
NSAIDs may impair blood-pressure control	105 (27.3)	0.27 (0.446)
NSAIDs increase cardiovascular risk in heart disease/hypertension	97 (25.3)	0.25 (0.435)
Medication-safety awareness		
Multi-NSAID use or switching increases risk	234 (60.9)	0.61 (0.489)

A common misconception was also assessed but excluded from the composite Knowledge score (see Table 1 note): 212 participants (55.2%) incorrectly agreed that "NSAIDs are safe for everyone because they are available without a prescription"; 172 (44.8%) correctly disagreed.

[Insert Fig. 1 here]

Overall Knowledge, Attitude, and Practice Scores

The mean Knowledge score was 3.32 ± 1.78 out of a possible 7. The mean Attitude score was 2.80 ± 0.70 out of a possible 5, with higher values intended to indicate a safer, more precautionary attitude; this mean falls below the scale midpoint of 3, indicating that attitudes toward NSAID safety in this sample were, on balance, mixed rather than clearly cautious. Among the 337 participants with complete practice data, the mean Practice score was 4.9 ± 2.41 out of a possible 10. The overall knowledge, attitude, and practice scores are presented in Table 5.

Table 5 Overall knowledge, attitude, and practice (KAP) scores			
KAP domain	Possible range	N	Mean $\pm$ SD
Knowledge score	0–7	384	3.32 ± 1.78
Attitude score	1–5	384	2.80 ± 0.70
Practice score	0–10	337	4.9 ± 2.41

NSAID Use Patterns According to Duration of Hypertension

Among the 329 participants with a documented NSAID-use history, use-frequency patterns differed significantly according to how long they had been diagnosed with hypertension ($p = 0.009$). Among those diagnosed for less than 1 year ($n = 22$), use was concentrated at lower frequencies: half (11, 50.0%) used NSAIDs 1–2 times per month, and none reported use of 3–7 times per week or daily. Among those diagnosed for 1–5 years ($n = 128$), 3–7 times per month was the most common pattern (55, 43.0%), with 12 (9.4%) reporting 3–7 times per week. Among those diagnosed for more than 5 years ($n = 179$), use had shifted toward higher frequencies: 63 (35.2%) reported 1–2 times per week and 41 (22.9%) reported 3–7 times per week, with 4 (2.2%) reporting daily use the only duration group with any daily users.

The primary indication for NSAID use also varied significantly by duration ($p < 0.001$). Joint and back pain became increasingly dominant with longer disease duration, rising from 28.6% (6 of 22) among those diagnosed less than 1 year, to 50.8% (65 of 128) among those diagnosed 1–5 years, to 70.6% (127 of 179) among those diagnosed more than 5 years. Headache showed the opposite pattern, declining from 28.6% to 32.0% to 18.3% across the same groups.

The method of obtaining NSAIDs was likewise significantly associated with duration of hypertension ($p < 0.001$). Self-medication (obtaining NSAIDs without a prescription) was most common among those recently diagnosed, accounting for 86.4% (19 of 22) of patients diagnosed less than 1 year. This

proportion declined steadily with longer disease duration: 48.4% (62 of 128) among those diagnosed 1–5 years, and 36.9% (66 of 179) among those diagnosed more than 5 years, with physician-prescribed use correspondingly rising to 63.1% (113 of 179) in the longest-duration group. NSAID-use patterns according to the duration of hypertension are presented in Table 6.

Table 6
NSAID use patterns according to duration of hypertension diagnosis (n = 329)

Variable	< 1 year (n = 22)	1–5 years (n = 128)	> 5 years (n = 179)	Total (n = 329)	p-value
Frequency of use					0.009
Less than once/month	2 (9.1%)	12 (9.4%)	2 (1.1%)	16 (4.9%)	
1–2 times/month	11 (50.0%)	29 (22.7%)	26 (14.5%)	66 (20.1%)	
3–7 times/month	7 (31.8%)	55 (43.0%)	41 (22.9%)	103 (31.3%)	
1–2 times/week	2 (9.1%)	20 (15.6%)	63 (35.2%)	85 (25.8%)	
3–7 times/week	0 (0.0%)	12 (9.4%)	41 (22.9%)	53 (16.1%)	
Daily	0 (0.0%)	0 (0.0%)	4 (2.2%)	4 (1.2%)	
Most common reason for use					< 0.001
Headache	6 (28.6%)	41 (32.0%)	33 (18.3%)	80 (24.3%)	
Joint / back pain	6 (28.6%)	65 (50.8%)	127 (70.6%)	198 (60.2%)	
Toothache	6 (28.6%)	11 (8.6%)	9 (5.0%)	26 (7.9%)	
Cold / fever	3 (14.3%)	11 (8.6%)	11 (6.1%)	25 (7.6%)	
Main source of obtaining NSAIDs					< 0.001
Non-doctor prescription (self-medication)	19 (86.4%)	62 (48.4%)	66 (36.9%)	147 (44.7%)	
Doctor's prescription	3 (13.6%)	66 (51.6%)	113 (63.1%)	182 (55.3%)	

Associations Between Characteristics and KAP Scores

Educational level was significantly associated with all three KAP domains Knowledge, Attitude, and Practice (all $p \leq 0.002$). The main source of obtaining NSAIDs (physician-prescribed versus self-directed) was also significantly associated with all three domains (all $p < 0.001$). Geographic region was significantly associated with the Attitude score but not with Knowledge or Practice. Kidney disease was significantly associated with both Attitude and Practice scores. Duration of hypertension and NSAID-use

status (current use versus reason for discontinuation) were significantly associated with Practice, and use status was also significantly associated with Attitude, but neither was associated with Knowledge. Frequency of NSAID use was significantly associated with Knowledge and Attitude but not Practice. Sex, diabetes, heart failure, previous myocardial infarction or stroke, and primary indication for use showed no significant association with any of the three KAP domains. Associations between participant characteristics and the knowledge, attitude, and practice scores are presented in Table 7.

Table 7

Association between sociodemographic, clinical, and behavioral characteristics and KAP scores

Variable	Knowledge	Attitude	Practice	Test used
Sex	0.748	0.149	0.971	Mann-Whitney
Diabetes mellitus	0.410	0.124	0.703	Mann-Whitney
Kidney disease	0.123	< 0.001	< 0.001	Mann-Whitney
Heart failure	0.115	0.819	0.821	Mann-Whitney
Previous MI/stroke	0.119	0.586	0.350	Mann-Whitney
Geographic region	0.156	< 0.001	0.080	Kruskal-Wallis
Educational level	< 0.001	0.002	< 0.001	Kruskal-Wallis
Duration of hypertension	0.205	0.243	< 0.001	Kruskal-Wallis
Main source of obtaining NSAIDs	< 0.001	< 0.001	< 0.001	Kruskal-Wallis
Most common reason for use	0.246	0.466	0.147	Kruskal-Wallis
NSAID-use status / discontinuation reason	0.036	< 0.001	< 0.001	Kruskal-Wallis
Frequency / duration-of-use pattern	< 0.001	< 0.001	0.143	Kruskal-Wallis

Values are *p*-values. Full Bonferroni-adjusted pairwise comparisons for each significant result are provided in Supplementary Tables S3–S7.

Correlations Among KAP Scores

Knowledge was positively correlated with Practice ($\rho = 0.300$, $p < 0.001$) and negatively correlated with Attitude ($\rho = -0.433$, $p < 0.001$). Attitude was negatively correlated with Practice ($\rho = -0.474$, $p < 0.001$). Age and duration of hypertension were positively correlated with one another ($\rho = 0.533$, $p < 0.001$), and duration of hypertension was also positively correlated with Practice ($\rho = 0.264$, $p < 0.001$). Age itself showed no significant correlation with Knowledge, Attitude, or Practice. Spearman correlations among the continuous study variables are presented in Table 8.

Table 8
Spearman correlations among continuous study variables

Variable pair	ρ	p-value	N
Age & duration of hypertension	0.533	< 0.001	384
Age & Knowledge	-0.071	0.165	384
Age & Attitude	0.046	0.373	384
Age & Practice	0.064	0.239	337
Duration of hypertension & Knowledge	-0.062	0.227	384
Duration of hypertension & Attitude	-0.085	0.097	384
Duration of hypertension & Practice	0.264	< 0.001	337
Knowledge & Attitude	-0.433	< 0.001	384
Knowledge & Practice	0.300	< 0.001	337
Attitude & Practice	-0.474	< 0.001	337

Independent Predictors of Knowledge, Attitude, and Practice

In multivariable linear regression, higher educational level ($B = 0.666$, $p < 0.001$) and obtaining NSAIDs by prescription ($B = 1.047$, $p < 0.001$) independently predicted higher Knowledge scores, while longer duration of hypertension independently predicted lower Knowledge scores ($B = -0.378$, $p = 0.030$). For the Practice score, longer duration of hypertension ($B = 0.950$, $p < 0.001$) was a significant positive independent predictor, while the Attitude score was a strong negative independent predictor ($B = -1.837$, $p < 0.001$): participants with a more cautious overall attitude reported less safe practical behavior. Educational level's bivariate association with Practice was not retained as an independent predictor in this model. For the Attitude score itself, geographic region ($B = -0.250$, $p < 0.001$), educational level ($B = -0.171$, $p < 0.001$), kidney disease ($B = -0.244$, $p < 0.05$), and prescription-based sourcing ($B = -0.398$, $p < 0.001$) were all significant independent negative predictors meaning more educated participants, those with kidney disease, those obtaining NSAIDs by prescription, and those in the Central region all scored lower (less cautious) on the Attitude scale, despite several of these same groups showing better Knowledge and/or Practice outcomes. Factors associated with the continuous knowledge, attitude, and practice scores are presented in Table 9.

Table 9
Multivariable linear regression: predictors of Knowledge, Attitude, and Practice scores

Predictor	Knowledge B (95% CI)	Attitude B (95% CI)	Practice B (95% CI)
Age, years	0.013 (– 0.003, 0.029)	0.001 (– 0.005, 0.007)	–0.002 (– 0.022, 0.017)
Sex	–0.208 (– 0.565, 0.150)	0.095 (– 0.040, 0.230)	0.028 (– 0.402, 0.459)
Governorate/region	–0.277 (– 0.623, 0.070)	–0.250 (– 0.381, – 0.119)**	–0.119 (– 0.550, 0.312)
Educational level	0.666 (0.462, 0.869)**	–0.171 (– 0.248, – 0.094)**	0.250 (– 0.011, 0.511)
Duration of hypertension	–0.378 (– 0.719, – 0.037)*	–0.017 (– 0.146, 0.112)	0.950 (0.538, 1.363)**
Taking antihypertensive medication	0.560 (– 0.275, 1.395)	–0.315 (– 0.630, 0.000)	–0.198 (– 1.204, 0.808)
Diabetes	–0.154 (– 0.550, 0.243)	0.077 (– 0.072, 0.227)	–0.082 (– 0.558, 0.393)
Kidney disease	0.410 (– 0.168, 0.989)	–0.244 (– 0.462, – 0.026)*	0.382 (– 0.316, 1.080)
Heart failure	0.002 (– 0.686, 0.690)	0.062 (– 0.198, 0.322)	–0.203 (– 1.026, 0.620)
MI / stroke	–0.463 (– 1.167, 0.241)	–0.004 (– 0.269, 0.262)	0.421 (– 0.424, 1.267)
NSAIDs obtained via prescription	1.047 (0.691, 1.402)**	–0.398 (– 0.532, – 0.264)**	0.436 (– 0.023, 0.895)
Attitude score	—	—	–1.837 (– 2.214, – 1.460)**
Knowledge score	—	—	0.023 (– 0.119, 0.164)

* $p < 0.05$; ** $p < 0.001$. Bold not applied per-cell here for readability given three outcomes per row; significance marked with asterisks instead.

Independent Predictors of Safe Practice

In multivariable logistic regression with the outcome oriented so that odds ratios above 1.0 indicate greater odds of safe practice obtaining NSAIDs through a physician's prescription (adjusted odds ratio [aOR] = 2.21, 95% CI 1.26–3.87, $p = 0.006$), secondary education relative to less-than-secondary education (aOR = 2.51, 95% CI 1.24–5.08, $p = 0.010$), male sex (aOR = 1.82, 95% CI 1.06–3.13, $p = 0.031$), longer duration of hypertension (more than 5 years versus less than 1 year: aOR = 6.02, 95% CI 1.47–

24.67, $p = 0.013$), and kidney disease (aOR = 2.61, 95% CI 1.04–6.59, $p = 0.042$) were independently associated with higher odds of safe practice. The Attitude score was the only significant negative predictor (aOR = 0.34, 95% CI 0.21–0.56, $p < 0.001$): each one-point increase in the (nominally safer) Attitude score was associated with substantially lower odds of safe practice, consistent with the pattern seen in the correlation and linear regression analyses. Knowledge score, university or postgraduate education (relative to less-than-secondary), 1–5 years' duration of hypertension, diabetes, heart failure, previous myocardial infarction or stroke, and region did not reach statistical significance as independent predictors. Factors associated with safe NSAID practice are presented in Table 10.

Note on the Attitude–Practice Relationship

Across every analysis conducted bivariate correlation, multivariable linear regression, and multivariable logistic regression and confirmed as robust in sensitivity analyses using the two original attitude item sets separately, the Attitude score was consistently and strongly negatively associated with actual safe-practice behavior. This finding held after adjustment for sociodemographic and clinical covariates and was not attributable to collinearity between predictors (all variance inflation factors remained below 2.0 across models). This pattern is consistent with a well-documented intention–behavior (or perception–reality) gap described in the health-psychology literature, whereby explicit endorsement of cautious beliefs does not reliably translate into cautious action. Because the study design is cross-sectional, the direction of causality in this relationship cannot be established, and this should be stated explicitly as a limitation of the study.

Table 10
Multivariable logistic regression: predictors of SAFE NSAID practice

Predictor	Reference	aOR	95% CI	p-value
Knowledge score	(continuous)	1.04	[0.88, 1.23]	0.666
Attitude score	(continuous)	0.34	[0.21, 0.56]	< 0.001
Sex: male	Female	1.82	[1.06, 3.13]	0.031
Region: Central	North	1.06	[0.59, 1.89]	0.854
Region: South	North	0.56	[0.07, 4.43]	0.584
Education: secondary	< secondary	2.51	[1.24, 5.08]	0.010
Education: university/diploma	< secondary	2.27	[0.98, 5.27]	0.057
Education: postgraduate	< secondary	1.74	[0.66, 4.54]	0.261
Duration of HTN: 1–5 years	< 1 year	3.77	[0.94, 15.16]	0.061
Duration of HTN: > 5 years	< 1 year	6.02	[1.47, 24.67]	0.013
Diabetes: yes	No	0.81	[0.45, 1.46]	0.483
Kidney disease: yes	No	2.61	[1.04, 6.59]	0.042
Heart failure: yes	No	1.63	[0.57, 4.70]	0.364
MI / stroke: yes	No	0.90	[0.31, 2.65]	0.848
NSAID source: doctor's prescription	Non-doctor / OTC	2.21	[1.26, 3.87]	0.006

Dependent variable coded Unsafe = 0, Safe = 1. aOR above 1 indicates greater odds of safe practice.

[Insert Fig. 2 here]

Discussion

The present study assessed knowledge, attitudes, and practices (KAP) regarding NSAID use and its cardiovascular and renal risks among 384 hypertensive patients in Palestine. NSAID use was widespread in this high-risk population, and knowledge of NSAID-associated risks, particularly cardiovascular risk, was suboptimal. Unexpectedly, the same characteristics that predicted better objective knowledge and safer practice (higher education, physician-prescribed sourcing, longer disease duration) also predicted a less overtly cautious Attitude score, a pattern discussed in detail below.

Patterns of NSAID Use

Most participants reported recent or ongoing NSAID use, and a substantial minority obtained NSAIDs without a prescription, consistent with reports that non-prescribed access to NSAIDs remains common

even among high-risk patients (13–15) This finding is clinically important given the well-established association between NSAID use and adverse cardiovascular and renal outcomes, particularly among individuals with hypertension and other chronic comorbidities(16).

Musculoskeletal complaints, particularly joint and back pain, were the primary reasons for NSAID use, consistent with evidence identifying these conditions as the most frequent indications for NSAID consumption in both community and clinical settings (17). A subset of participants reported frequent (weekly or daily) use; such cumulative exposure has been linked to worsening blood pressure control and renal decline (18, 19). Physician advice was the most common reason for discontinuation, underscoring the role of clinicians in reducing inappropriate exposure (20).

Knowledge Regarding NSAID-Associated Cardiovascular and Renal Risks

The present study demonstrated overall suboptimal knowledge regarding NSAID-associated cardiovascular and renal risks among hypertensive patients. Although awareness of general NSAID-related nephrotoxicity was relatively high, consistent with previous studies conducted in the region (21), important knowledge gaps remained regarding specific high-risk clinical situations, particularly NSAID use among patients with pre-existing kidney disease, which is a well-established risk factor for NSAID-induced acute kidney injury(19). Awareness of the increased risk associated with NSAID use during dehydration or reduced fluid intake was comparatively higher than other renal-related items; however, it remained insufficient considering the established role of volume depletion as a major precipitating factor for NSAID-induced acute kidney injury (22).

Participants also demonstrated important misconceptions regarding the safety of over-the-counter NSAIDs. A substantial proportion believed that these medications are universally safe despite their easy availability, reflecting persistent underestimation of their potential adverse effects and limited risk perception regarding self-medication (23)(21).

Knowledge of cardiovascular risks was considerably poorer than knowledge of renal complications. Less than half of participants recognized that NSAIDs may increase blood pressure, while only a minority understood their potential to impair blood pressure control or increase cardiovascular risk among hypertensive individuals. Similar findings have been reported in previous regional studies (21). This lack of awareness is clinically concerning because NSAIDs are known to attenuate the antihypertensive effects of several medications while increasing the risk of cardiovascular events, particularly among patients with hypertension and underlying cardiovascular disease (24, 25)

The discrepancy observed between renal and cardiovascular knowledge may reflect differences in patient education and public awareness, with renal complications receiving greater emphasis than cardiovascular adverse effects during counseling and health education. Overall, these findings highlight

the need for targeted educational interventions aimed at improving patients' understanding of both cardiovascular and renal risks associated with NSAID use in hypertensive populations (26).

The Attitude-Practice Relationship: A Perception-Reality Gap

The most striking finding of this study was a consistent, robust negative association between the Attitude score and actual safe-practice behavior, replicated across bivariate correlation ($\rho = -0.474$, $p < 0.001$), multivariable linear regression ($B = -1.837$, $p < 0.001$), and multivariable logistic regression (aOR = 0.34, 95% CI 0.21–0.56, $p < 0.001$), and confirmed in sensitivity analyses using the two original item sets separately (Supplementary Table S2). Because higher Attitude scores reflect greater endorsement of cautious, safety-oriented beliefs, this pattern means that patients who most strongly endorsed cautious attitudes were, on average, the least likely to act on them in practice. Formal collinearity diagnostics ruled out a statistical artifact as the explanation (variance inflation factors were low, 1.47–1.96, across all models) (27, 28), supporting a substantive rather than a purely methodological explanation.

One possible interpretation is that this pattern may reflect a gap between reported attitudes and actual behavior, sometimes described as an intention–behavior or attitude–behavior gap in the health-psychology literature. In this context, endorsing cautious beliefs may not always translate directly into cautious behavior, particularly for practices such as self-medication that may be influenced by habit, symptoms, or previous experience(29). Similar differences between medication-related knowledge or beliefs and self-medication practices have been reported in previous studies (30, 31). Interestingly, several characteristics associated with better Knowledge and Practice in the present study, including higher education, physician-prescribed medication use, longer disease duration, and pre-existing kidney disease, were also associated with lower Attitude scores. One possible explanation is that individuals with greater clinical experience, counseling exposure, or education may follow safer medication practices without necessarily expressing stronger precautionary attitudes. Conversely, cautious responses to attitude items may not always be reflected in everyday medication practices. This interpretation is broadly consistent with literature suggesting that stated attitudes or intentions do not necessarily correspond directly to behavior (29). However, other explanations are also possible, and given the cross-sectional design of this study, these findings should be interpreted cautiously and warrant further investigation.

Taken together, these findings indicate that although hypertensive patients generally acknowledge the importance of professional guidance, important misconceptions and unsafe medication practices remain common. Given the established association between NSAID exposure, elevated blood pressure, reduced antihypertensive effectiveness, and adverse renal outcomes, these findings underscore the need for targeted educational interventions and pharmacist-led counseling strategies that facilitate the translation of risk awareness into safer medication practices among hypertensive patients.

Sociodemographic and Clinical Determinants of KAP

Educational level was the most consistent bivariate correlate across all three domains (all $p \leq 0.002$), reinforcing the role of health literacy in medication-related knowledge and behavior (30, 32, 33). In multivariable analysis, education independently predicted higher Knowledge ($B = 0.666$, $p < 0.001$) but independently predicted lower Attitude scores ($B = -0.171$, $p < 0.001$): the opposite direction; its bivariate association with the continuous Practice score was not retained as an independent predictor after adjustment (95% CI crossed zero), although secondary (versus less-than-secondary) education did independently predict higher odds of safe practice in the logistic model ($aOR = 2.51$, $p = 0.010$). This contrasts with general-population evidence that greater education is typically associated with higher risk perception (34), and instead suggests that in this sample the more educated and more experienced patients expressed the least overt caution while still tending to behave more safely, which is consistent with the perception–reality gap discussed above. Geographic region was significantly associated with Attitude only, with Central-region participants scoring lower than those in the North; because no corresponding differences emerged for Knowledge or Practice, this most likely reflects local variation in health messaging rather than a true difference in underlying safety behavior. Most comorbidities (diabetes, heart failure, prior myocardial infarction/stroke) showed no significant association with any KAP domain, consistent with prior evidence that chronic-disease burden alone does not guarantee better medication-related knowledge or behavior (35, 36). Kidney disease was a bivariate exception, showing significant differences in Attitude and Practice scores ($p < 0.001$ for both), plausibly reflecting closer clinical monitoring (37–39). In the fully adjusted models, kidney disease independently predicted both a lower Attitude score ($B = -0.244$, $p < 0.05$) and higher odds of safe practice ($aOR = 2.61$, 95% CI 1.04–6.59, $p = 0.042$), which again shows the same pattern of lower stated caution alongside safer behavior. Longer duration of hypertension independently predicted lower Knowledge ($B = -0.378$, $p = 0.030$) but higher Practice scores ($B = 0.950$, $p < 0.001$), suggesting that safe habits may accumulate with disease experience even as specific factual knowledge is not reinforced during routine follow-up (40–42).

Overall, these findings indicate that educational attainment, rather than demographic or geographic characteristics, is the principal determinant of NSAID-related knowledge, attitudes, perceptions, and medication practices, emphasizing the importance of health literacy–based educational interventions to improve medication safety among hypertensive patients.

Influence of NSAID Utilization Patterns

Physician-prescribed sourcing was consistently associated with better Knowledge ($B = 1.047$, $p < 0.001$) and higher odds of safe practice ($aOR = 2.21$, 95% CI 1.26–3.87, $p = 0.006$), underscoring the educational value of the prescribing encounter (20, 33). NSAID use-frequency showed a more complex pattern: more frequent use was associated with lower Knowledge scores, but, counterintuitively, with higher (more cautious-sounding) Attitude scores, with the heaviest users (3–7 times per week) reporting both the least factual knowledge and the most emphatic safety-oriented attitude of any frequency group. This dissociation is a further illustration of the perception–reality gap described above, and suggests that the heaviest users may compensate for limited factual knowledge with generic expressions of caution that are not reflected in reduced exposure (13, 43).

These findings likely reflect the educational value of physician-patient interactions, during which counseling regarding appropriate NSAID use and potential cardiovascular and renal adverse effects may improve patients' understanding and medication-related behaviors. Similar findings have been reported in previous studies demonstrating greater medication knowledge and risk awareness among patients receiving professional counseling compared with individuals relying primarily on self-medication (44).

Previous NSAID experience and reasons for discontinuation also showed significant associations with all KAP domains, highlighting the influence of medication experience and physician involvement on patients' knowledge and risk perception. Individuals who discontinued NSAID use following physician advice generally demonstrated more favorable medication practices and greater awareness of NSAID-related risks than current users or those relying on non-medical advice. Interestingly, knowledge and safety-seeking scores were highest among participants who had never used NSAIDs, whereas risk-minimization scores were greatest among participants whose NSAID use involved physician guidance, either through prescription-based therapy or medically supervised discontinuation. Together, these findings suggest that physician involvement throughout the course of NSAID therapy may substantially improve patients' perception of medication-related risks and encourage safer medication-related decision-making. Previous studies have likewise demonstrated that physician counseling is positively associated with NSAID risk awareness, objective medication knowledge, and avoidance of inappropriate NSAID use (20).

Independent Predictors of NSAID-Related Knowledge

Multivariable analysis identified educational attainment as one of the strongest independent predictors of NSAID-related knowledge, with higher educational levels being associated with greater awareness of the cardiovascular and renal risks of NSAID use. This finding is consistent with previous evidence demonstrating that educational attainment is strongly associated with improved medication knowledge (30). Similar associations have been reported using validated instruments, including the Medication Knowledge Scale developed by Marks et al. and adapted questionnaires such as that used by Okuyan et al.(45). The consistency of these findings across different assessment tools strengthens the credibility of the present results and provides indirect support for the construct validity of the questionnaire used in this study.

Obtaining NSAIDs through a physician's prescription was also independently associated with higher knowledge scores, highlighting the important educational role of healthcare professionals in promoting safe medication use. Physician prescribing may function as an indirect educational intervention by providing patients with essential information regarding medication indication, dosing, duration of treatment, and potential adverse effects at the point of care(46). Previous studies have similarly demonstrated that medication counseling significantly improves patients' understanding of medication indications, dosing schedules, adverse effects, and overall medication knowledge (30). Accordingly, both structured counseling and routine prescribing practices may contribute to greater patient understanding of NSAID-associated cardiovascular and renal risks (40). These findings suggest that routine clinical

encounters provide valuable opportunities to strengthen patient education through brief, targeted medication counseling.

Interestingly, longer duration of hypertension was independently associated with lower knowledge scores. One possible explanation is that patient education is often insufficiently reinforced during long-term follow-up. In routine clinical practice, follow-up visits frequently focus on blood pressure control, medication adjustment, and disease monitoring, whereas counseling regarding over-the-counter medications and their potential risks may receive less attention (47, 48). Similar deficiencies have been reported in chronic cardiovascular care settings in low- and middle-income countries, where many patients continue to demonstrate important medication knowledge gaps despite years of ongoing clinical care(49) .

Independent Predictors of Safe NSAID Practices

In the multivariable logistic regression, physician-prescribed sourcing (aOR = 2.21, $p = 0.006$), secondary (versus less-than-secondary) education (aOR = 2.51, $p = 0.010$), male sex (aOR = 1.82, $p = 0.031$), longer disease duration (> 5 years: aOR = 6.02, $p = 0.013$), and kidney disease (aOR = 2.61, $p = 0.042$) independently predicted safe practice; the Attitude score was the only significant negative predictor (aOR = 0.34, $p < 0.001$). Because the outcome in this corrected model is coded so that odds ratios above 1.0 indicate safer practice, these associations should be interpreted directly, in particular, male participants in this dataset had higher, not lower, odds of safe practice.

Overall Interpretation

Taken together, educational attainment, physician involvement, and disease duration emerged as the principal, generally coherent, determinants of safer Knowledge and Practice, while the Attitude score behaved as an independent, and inversely related, construct rather than a mediator of safe behavior. This reframes NSAID-related “attitude” in this population less as a protective factor and more as a marker of unresolved concern or lower confidence, and reinforces the need for interventions that target actual behavior directly, such as pharmacist-led counseling at the point of dispensing, rather than relying on belief-based education alone (20, 35, 50).

Limitations

This study has several limitations. First, its cross-sectional design prevents conclusions about causality or the temporal direction of observed associations. Second, all information was self-reported and may therefore be affected by recall and social-desirability bias. Third, the facility-based, nonprobability sampling method may limit generalizability to the broader hypertensive population. Although recruitment was conducted at several centers, only seven participants were recruited from the southern region, limiting the reliability of regional comparisons. Fourth, complete Practice-score data were unavailable for some participants, creating a possibility of nonresponse bias. Fifth, two related NSAID-use variables produced inconsistent responses for 11 participants. Sixth, the study-specific questionnaire underwent

expert review and pilot testing but had not previously undergone full psychometric validation, and the Knowledge scale demonstrated modest internal consistency. Seventh, multiple comparisons increased the possibility of type I error. Finally, objective measures such as blood pressure, renal function, NSAID dose, and documented cardiovascular or renal events were not collected.

Conclusion

NSAID use was common among adults with hypertension attending healthcare facilities in the West Bank, and a substantial proportion obtained these medications without a physician's prescription. Awareness of renal harm was greater than awareness of cardiovascular and blood-pressure-related risks. Higher educational attainment and prescription-based NSAID acquisition were associated with better knowledge and safer reported practices. These findings support incorporating routine questions about nonprescription NSAID use and brief cardiovascular and renal safety counseling into hypertension care. Further research using validated instruments and objective clinical outcomes is needed to confirm the observed relationships between attitudes and medication-use behavior.

Abbreviations

AKI: Acute kidney injury

aOR: Adjusted odds ratio

CI: Confidence interval

COX: Cyclooxygenase

COX-2: Cyclooxygenase-2

HTN: Hypertension

KAP: Knowledge, attitudes, and practices

MI: Myocardial infarction

NSAID: Nonsteroidal anti-inflammatory drug

OTC: Over-the-counter

SD: Standard deviation

SPSS: Statistical Package for the Social Sciences

VIF: Variance inflation factor

Declarations

Ethics approval and consent to participate

The study was approved by the Institutional Review Board of An-Najah National University (IRB reference number: Med. Jan. 2026/34). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and applicable institutional guidelines. Written informed consent was obtained from all participants before enrollment.

Consent for publication

Not applicable.

Availability of data and materials

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

HK conceptualized the study. HK contributed to the methodology and questionnaire development. OS, SA, and OB coordinated data collection. HK performed the statistical analysis. OS, SA, and OB interpreted the findings and drafted the manuscript. All authors critically reviewed the manuscript, approved the final version, and agree to be accountable for the work.

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Generative AI declaration

During preparation of this manuscript, the authors used ChatGPT, developed by OpenAI, for language editing and improving clarity. All generated content was reviewed and revised by the authors, who take full responsibility for the final manuscript. The tool was not used to generate, modify, or analyze the study data.

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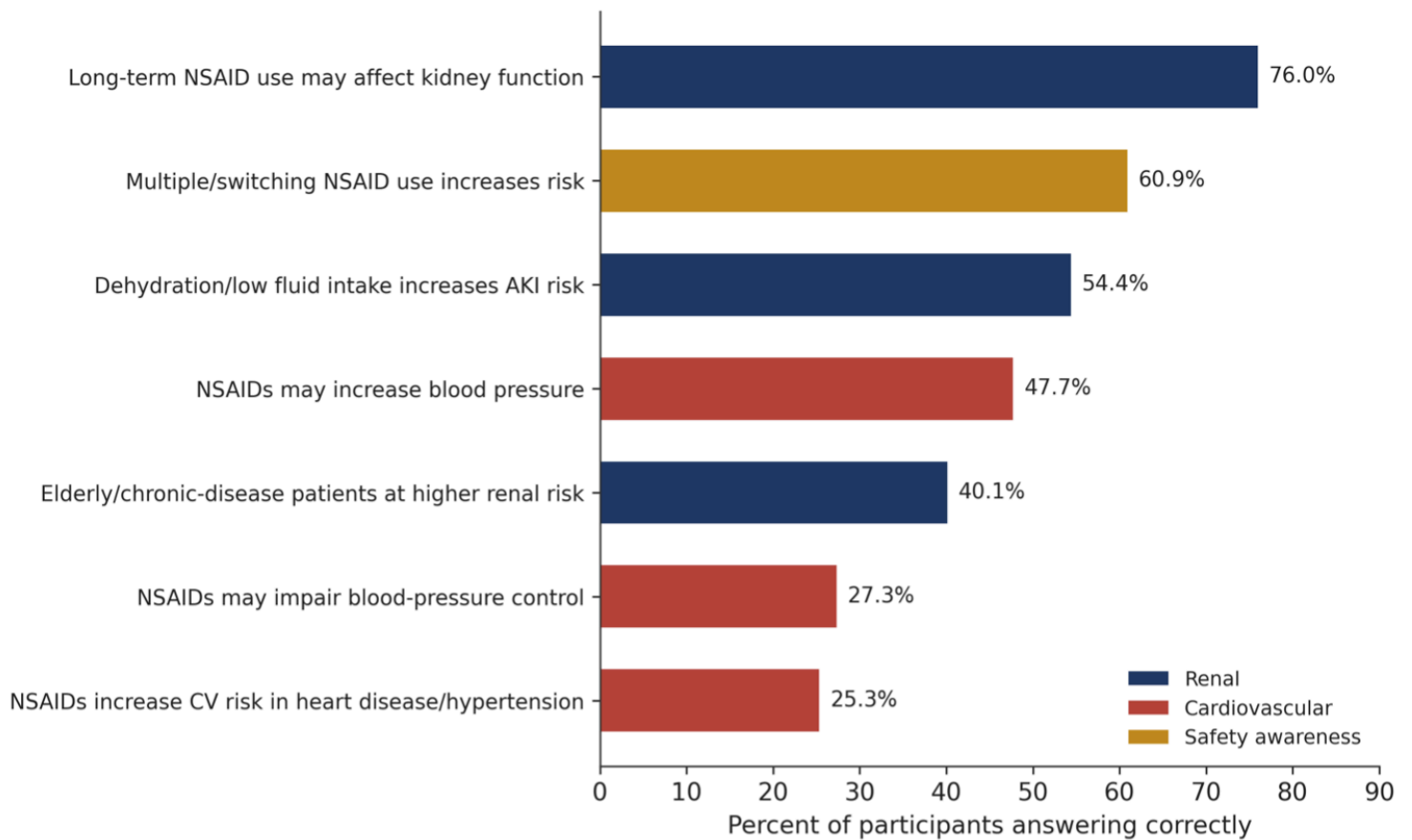
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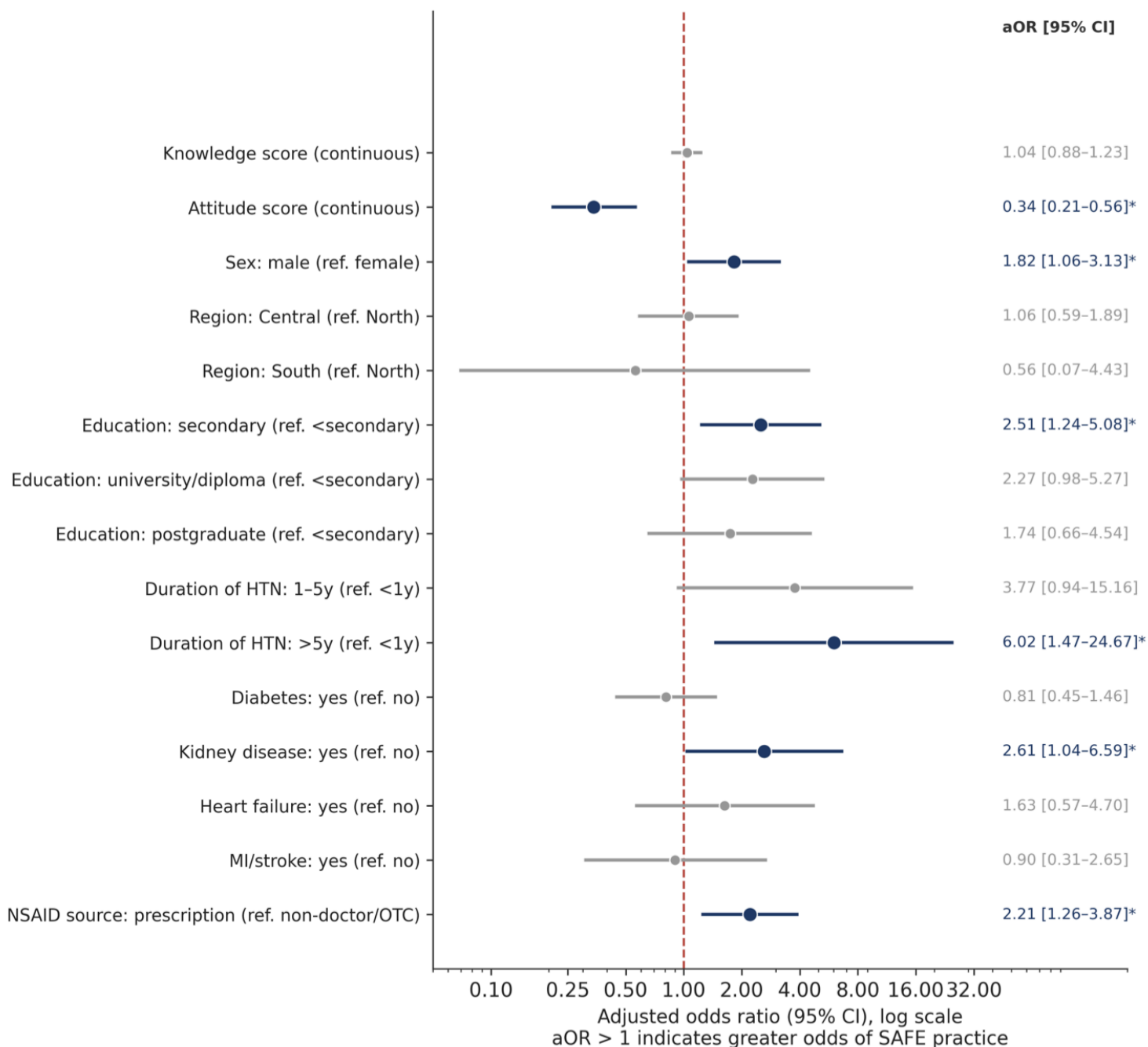
Figures



Renal-risk items were generally better recognized than cardiovascular-risk items (N = 384).

Figure 1

Knowledge of cardiovascular and renal risks associated with NSAID use among adults with hypertension. Bars represent the percentage of participants who answered each item correctly. Renal effects were more frequently recognized than cardiovascular and blood-pressure-related effects. AKI, acute kidney injury; NSAID, nonsteroidal anti-inflammatory drug. N = 384.



* $p < 0.05$. Filled navy markers = statistically significant predictors; gray = not significant.

Figure 2

Factors independently associated with safe NSAID practice among adults with hypertension. Points represent adjusted odds ratios, and horizontal lines represent 95% confidence intervals. The dependent variable was safe practice, defined as a practice score ≥ 5 and coded as 1. Odds ratios above 1 indicate greater odds of safe practice. aOR, adjusted odds ratio; CI, confidence interval; HTN, hypertension; MI, myocardial infarction; NSAID, nonsteroidal anti-inflammatory drug; OTC, over-the-counter.

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