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The prevalence and contributing factors of NSAIDs prescription among chronic kidney disease patients in primary care: a mixed methods study from Kingdom of Bahrain

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Abstract

Background The prevalence of Non-steroidal Anti-Inflammatory Drugs (NSAIDs) prescription and its contributory factors among chronic kidney disease (CKD) patients are unknown in the Kingdom of Bahrain – though NSAIDs are known to cause significant renal impairment. This study will determine the prevalence of NSAIDs prescription among CKD patients and the contributory factors to this behavior from the perspective of primary care physicians in Bahrain.

Methodology A sequential mixed-method design study comprising of a retrospective cross-sectional survey drawn from patients' electronic medical records (EMR) and qualitative in-depth interviews with primary care physicians (PCPs) was conducted between December 2022 and January 2023 – with an EMR data lookback from 1 st June 2021 to 1 st June 2022 Quantitative descriptive analysis was conducted to estimate the prevalence of NSAIDs and their associations with sociodemographic and service delivery indicators. An Ishikawa diagram was used to describe contributory factors to NSAID prescription among CKD patients drawing from the literature and was used to guide a deductive thematic analysis of the qualitative data.

Result Of the enrolled CKD patient population (4,380 patients), 17.4% had at least one inappropriate NSAID prescription. 80% of these patients had moderate renal impairment, while 19.3% had severe impairment. Most of the prescriptions were in 24-h health centers (48.5%). A Bivariate relationship between the prescription and the sociodemographic factors showed a significant P value regarding age (*P*-value 0.008*) and the severity of the renal impairment (*P*-value < 0.001*). The contributory factors were divided into five themes: patient factors, physician factors, health team factors, I SEHA factors and system factors. Of these themes, patients and PCPs were identified by the primary care physicians as some of the most important reasons for NSAIDs prescription among CKD patients.

Conclusion The prevalence of NSAIDs prescription among CKD patients is relatively high in the kingdom of Bahrain – largely due to patient and physician factors as identified by primary care physicians. Possible solutions for addressing these factors include raising awareness among patients, PCPs, and other healthcare workers and activating the Swiss

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Cheese Model that involves patients, PCPs, and other health team members to ensure appropriate medication practice and patients' safety.

Keywords CKD (chronic kidney disease), NSAID (non-steroidal anti-inflammatory drugs), PCP (primary care physician), EMR (electronic medical records)

Introduction

Chronic kidney disease (CKD) is increasing worldwide relatively with the increase in life expectancy and the growing elderly population. CKD poses as a significant burden to the patient, the family members/caregivers, the healthcare system, and the economy. According to a systemic review CKD patients can present with a wide variety of symptoms [1]. Another systemic review reported moderate to severe levels of burden in caregivers of patients undergoing hemodialysis. Multiple studies concluded that caregiver burden increases with decreased functional independence and worsening health of the patient [2]. Additionally, CKD poses a significant burden on the secondary healthcare system. A retrospective cohort study showed that 47% of CKD patients were hospitalized at least once and patients had an average of 6.6 hospital days and 4.0 outpatient nephrology visits a year [3].

A systemic review and meta-analysis concluded that high-dose NSAID use significantly increases the risk of accelerated renal function decline by 26% [4]. NSAIDs can induce a range of renal complications by inhibiting the production of renal prostaglandins mainly. These complications encompass fluid and electrolyte disturbances, acute kidney injury, nephrotic syndrome, interstitial nephritis, and renal papillary necrosis. Furthermore, NSAIDs can exacerbate blood pressure control challenges, particularly when used in conjunction with angiotensin-converting enzyme (ACE) inhibitors, diuretics, or beta-blockers [5]. International practice guidelines illustrate that there is a gray zone where NSAIDs can be prescribed according to the GFR level. These guidelines recommend "complete NSAID avoidance in patients with a glomerular filtration rate (GFR) < 30 mL/min/1.73 m2 and avoidance of prolonged use in patients with a GFR < 60 mL/min/1.73 m2" [6].

Multiple research projects across many countries have shown that they are inappropriately prescribed for CKD patients [7–9]. A study done in Turkey showed that NSAIDs were used by 66.2% in CKD patients above 65 years of age [10]. A cross-sectional study done in Egypt reported about two-thirds (65.7%) of the study patients used NSAIDs [11]. In the Kingdom of Saudi Arabia, a study of potentially inappropriate medications (PIMs) being prescribed to the elderly population (defined as above 60 years of age) and found that NSAIDs were the second most used PIMs at 17.2% [12].

According to the literature this problem is propagated by the patients themselves, physicians and to some extent healthcare management. One study showed that some of the CKD patients are taking the NSAIDs over the counter, some are being prescribed these drugs by a physician and some are given these drugs by a pharmacist [7]. Another study showed that "The majority of NSAID users (76.5%) used NSAIDs by self-decision, while 25.2% used them after the advice of physicians" [11].

Several studies attributed the high use of NSAIDs by CKD patients to multiple factors including that lack of patient awareness about their chronic conditions, contraindicated medications, and poor medical education were some of the major reasons behind suboptimal CKD management [10, 13]. As well as possible physician factors like lack of experience in managing pain and unfamiliarity with indications for prescribing NSAIDs, and surprisingly, increased physician work experience was associated with increased prescriptions [13]. A systematic review found that shorter clinic visits, inadequate resource allocation, and the lack of referral clarity to nephrologists don't allow physicians enough time to assess for contraindications to NSAIDS, having difficulty in recognizing a CKD diagnosis and difficulty in informing the patients of their CKD diagnosis [14]. An Australian cross-sectional study deduced that a possible explanation is that "some GPs may not consider an eGFR measurement between 45–59 mL/min/1.73 m2 as evidence of CKD in older individuals. They might consider these eGFR values as reflecting the normal physiological changes related to aging" [15].

Many of the studies discussed interventions to this problem. Some recommended tackling this issue from the patient's level by "empowering patients to make the right treatment decisions" [13]. Others tried successfully to provide education by pharmacists to primary care providers on safe NSAIDs prescribing habits in high-risk patient populations [16]. Others recommended that physicians prescribe NSAIDs with the shortest duration and lowest effective dose [17]. An alternative is "opting for judicious use of topical NSAIDs" or to use non-nephrotoxic analgesics [18]. In another study, 40% of physicians thought that a Computerized clinical decision support systems (CCDSS)

would allow them to improve their daily practice as it "solved their doubts and above all it provided them with new options to solve their prescription problems" [19].

Regardless of the factors that lead to the inappropriate prescription of NSAIDs in CKD patients worldwide and its outcomes, here in the Kingdom of Bahrain, there is a lack of data on this issue. I-Seha is an electronic medical records system that is being used in Bahrain across 28 primary healthcare centers and secondary health hospitals [20]. I-Seha serves as a centralized "computerized medical information system that collect, store, and display patient information, to create legible and organized recordings, and to access clinical information of patients" Through this system, HCPS also prescribe medications, though their approach to prescriptions has not been studied and the prevalence rate of inappropriate prescriptions in general and with NSAIDS is not known. In addition, there are no local Bahraini guidelines on NSAID prescriptions in the management of CKD patients. However, based on the literature it is highly plausible that NSAIDs are being inappropriately prescribed to CKD patients in the primary care setting here in Bahrain.

Some statistics that can be used to compare Bahrain's performance in treating CKD patients, in general, in comparison to the developed world is the mortality rate. The mortality rate of CKD is much higher in Bahrain at 4.64% of total deaths, according to the data published by the WHO in 2020 [21], compared to the mortality rates in some developed countries. In the UK the mortality rate for CKD patients was at 1.07%, and it was at 1.96% and 3.43% for Canada and the US respectively. Another source says that "CKD is the number 5 cause of total death in Bahrain in both 2009 and 2019" [21]. Thus, CKD is a major health concern in this country that needs to be studied more thoroughly.

In conclusion, inappropriate prescription of NSAIDs in CKD patients is a real problem that occurs worldwide and has real ramifications for the patient, the caregivers, the healthcare system and the economy. This research aims to ensure the safety of the primary health care patients in the Kingdom of Bahrain by reducing the prescriptions of NSAIDs in CKD patients. The study objectives that set out were to estimate the prevalence of NSAIDs prescription in the CKD population in primary health care in Bahrain, and to measure the prevalence of CKD documentation in the chronic problem list which appear in the main page in the I SEHA. In addition, another objective was to explore the barriers/challenges that contribute to NSAIDs prescribing from the perspective of primary care physicians and to suggest feasible solutions to address this problem.

Methods

Definition of CKD

CKD is defined as "decreased kidney function shown by glomerular filtration rate (GFR) of less than 60 mL/min per 1·73 m^2, or markers of kidney damage, or both, of at least 3 months duration, regardless of the underlying cause' [22]. While other indicators of kidney damage, such as the albumin/creatinine ratio, creatinine, and urea, are primarily used for the detection and prognosis of CKD, the eGFR is essential for accurately classifying the stages of the disease.

Study design

The study design consisted of a mixed design study combining a secondary analysis of data from electronic medical records to estimate the prevalence of NSAIDs prescription to CKD patients documented in the I-Seha database and in-depth interviews of physicians to explore the contributary factors determining these prescriptions from the perspectives of treating doctors. The I-Seha database is an integrated electronic medical record used for all patient encounters in the Kingdom of Bahrain from the primary to the secondary care system in the governmental sector; where all laboratory investigations, radiological investigations, pharmaceutical prescriptions, nursing orders, physiotherapy notes, dental notes, doctors' notes, referrals and medical reports are available through the patient's personal number (CPR). The first page of the I-SEHA system includes a section dedicated to chronic diseases the patient has, such as hypertension, diabetes mellitus, chronic kidney disease, and others. This section is essential for quickly identifying patients'health issues and ensuring appropriate management and treatment strategies are implemented.

For the quantitative part of the study, secondary data set has been obtained from the I-Seha electronic medical records. The study sample is all Bahraini and Non-Bahraini patients with CKD in the period from 1st June 2021 to 1st June 2022. It includes all the patients who had an eGFR done, from both primary and secondary care, considering the inclusion and exclusion criteria. A total of 10,594 patients had at least one eGFR test result of < 60 L/min/1,73 m^2 in the selected duration. However, the sample size was chosen according to the internationally recognized definition of CKD [11] leading to 4,380 CKD patients.

In our study, the 4,380 CKD patients were stratified into two age groups: those under 65 years and those 65 years and older. This division was based on an analysis of the age distribution and the median age of the cohort, and it is consistent with previous research indicating a higher prevalence of CKD among older adults [23].

A formal request was sent to the I-Seha Information and Planning Directory (IPD) team in the Ministry of Health that details all the variables and data that is to be collected supported by screenshots for the area of interest. The variables included: patient demographics, eGFR level, CKD diagnosis documentation in problem list (using ICD 10; N 18), NSAIDs prescription along with the prescribing physician and location of prescription. Accordingly, the I-Seha IT team extracted the data from their database and provide three datasets that fit the inclusion criteria. Chi-square test permitted to test the association between categorical variables and pooled T test was done to compare the means of continuous ones. All these tests are performed using the statistical analysis using "SPSS Statistics 28.0.1.1".

Inclusion and exclusion criteria

Adult Bahraini and Non-Bahraini patients aged 18 years and above who had an eGFR test requested by either primary or secondary care in the governmental sector in Bahrain in the period from 1st June 2021 to 1st June 2022 are included. Two eGFR results of < 60 L/min/1,73 m^2 with at least 3 months apart are needed to meet the international criteria of CKD diagnosis. The eGFR was calculated according to MDRD (Modification of Diet in Renal Disease) formula, In addition, the only analgesic NSAIDs that are available for prescription from the primary health care in Bahrain are ibuprofen, naproxen, diclofenac sodium, mefenamic acid and/or indomethacin. As aspirin is not an analgesic, but a commonly prescribed long-term prophylactic medication for cardiac patients, this medication was excluded. COX- 2 selective inhibitors are not available in the primary health center for prescription by the family physicians and as such were excluded.

The study excluded any patient who is not a CKD by definition (eGFR test done once and/or less than 3 months between each eGFR tests). Plus, any NSAIDs prescriptions from secondary care and temporary and/or unregistered identification in the I-SEHA system.

As for the qualitative part, in-depth interviews were conducted with both board-certified family physicians and general practitioners in the primary health care centers in Bahrain in the period between December 2022 and January 2023. Purposive sampling with maximum variation (gender, degree of experience, specialty and nationality) was used. Interviews were conducted till saturation was reached (a total of eleven interviews). A simple in-depth interview guide was developed (appendix 1) to explore the contributary factors behind the prescription of NSAIDs in CKD patients. The interviews were conducted in the physician's room in their respective health centers and took approximately 20 min. Each interview was conducted by two researchers; one was conducting the interview while the other was recording and taking notes. Afterwards, the interviews were transcribed and edited through "happyscribe.com". Tools for root cause analysis such as fishbone have been used to analyze and present the findings. Thematic analysis was done by categorizing the collected data into themes including contributory factors and proposed solutions. In addition, NVivo software was used to analyze the different themes explored.

Table 1 Descriptive statistics for study population demographics

Variables		*N* (4,380)	
Age	< 65	1673	(38.2)
	≥ 65	2707	(61.8)
Gender	Male	2229	(50.9)
	Female	2151	(49.1)
Nationality	Bahraini	4103	(93.7)
	Non-Bahraini	277	(6.3)

Ethical consideration

For the quantitative part: the confidentiality of the patients and their personal information will not be disclosed. All data collectors and researchers signed a form that commits them to withhold sharing any patient information. Informed consent was obtained from all participants and their legal representatives.

For the qualitative part: oral consent was taken from the participating physicians, and they were informed about the study's aims and objectives. They remained anonymous and their participation in the study was voluntary, and they can withdraw if they wish to do so at any point. They were informed that the interviews would be recorded.

Ethical approval was taken from the research and ethics committee at Arabian Gulf University (E06-PI- 11–22).

It is unlikely that any form of harm (psychological, social, physical, legal) will come to the participating parties as none of their personal information will be revealed.

Results

Quantitative result

The total study population was 4,380 patients, representing the greater Bahraini population (Table 1).

The prevalence of NSAID prescriptions in the selected population is 761 (17.4%). In contrast, CKD documentation in the I-SEHA system's problem list is only 14 (0.3%). Most patients fall into the category of

Table 2 Descriptive data on CKD documentation, number of NSAID prescriptions, and CKD severity

Variables		*N* (4,380)	
CKD Documentation as a problem list	No documentation	4366	(99.7)
	Documented	14	(0.3)
Number of NSAID prescriptions	No prescription	3619	(82.6)
	One prescription or more	761	(17.4)
Severity of CKD	Moderate renal impairment (eGFR 30–60)	3535	(80.7)
	Severe Renal Impairment (eGFR < 30)	845	(19.3)

Table 3 Relationship between prescribing NSAIDs and selected study variables

Variable	Not prescribed *N* (%)	Prescribed *N* (%)	*P*-value
Age			
< 65	1350 (37.3)	323 (42.4)	**0.008***
≥ 65	2269 (62.7)	438 (57.6)	
Gender			
Male	1830 (50.6)	399 (52.4)	0.350
Female	1789 (49.4)	362 (47.6)	
Nationality			
Bahraini	3398 (93.9)	705 (92.6)	0.197
Non_Bahraini	221 (6.1)	56 (7.4)	
eGFR reading			
60–30	2862 (79.1)	673 (88.4)	**< 0.001***
< 30	757 (20.9)	88 (11.6)	
CKD documentation as a problem list			
No	3606 (99.6)	760 (17.4)	0.312
Yes	13 (0.4)	1 (7.1)	

* **Statistically significance**

moderate renal impairment, defined as a glomerular filtration rate (GFR) of 30 to 60 mL/min/1.73 m^2, with 3535 patients (80.7%) classified in this group (Table 2).

The bivariate relationship between the NSAID prescription and the Descriptive factors shows a significant *P* value regarding the age variable (*P*-value 0.008*) and the severity of the renal impairment as a variable (*P*-value < 0.001*) (Table 3).

Qualitative results

As for the qualitative part PCPs were asked about the magnitude of this problem and there were opposing opinions. Some doctors believed that the prescription of NSAIDs in CKD patients is not a common practice and did not perceive it as a major issue. Others expressed that it was a much bigger issue before the I-SEHA system was implemented in the governmental health care centers in Bahrain. Another group of doctors indicated that NSAID prescriptions in CKD are substantial and significant till today.

Thematic analysis of the qualitative data revealed that the contributing factors which were categorized into five themes: patient factors, physician factors, health team factors, I-SEHA factors and system factors (Fig. 1).

Patient factors

Many of the doctors interviewed thought that patients themselves had a role in NSAID prescription due to the lack of knowledge of their CKD diagnosis and disease implications. This was especially noticed in difficult patients and those with multiple comorbidities. One of the doctors said "Most of the CKD people are elderly and they have osteoarthritis, and they have been used to taking NSAIDs. So, if you haven't prescribed it, they will go buy it from outside and you cannot control outside pharmacies". On the other hand, doctors revealed that some patients are aware of their CKD diagnosis, yet they are dishonest with their doctors, and some may even visit different doctors to get NSAID.

Physician factors

As for the physician factors, Interviewees stated that doctors do not provide proper education for the patient about CKD considering the diagnosis, implication of the disease and the contraindicated medications. Doctors also mentioned that most of them rely on patients in history giving. Moreover, some physicians neglect taking a proper medical history and reviewing the patient's medications. One of the doctors said, "Maybe he prescribes without noticing the kidney function, maybe the medications just get renewed without reviewing them".

Another proposed contributing factor is that some doctors find difficulty in interpreting renal function test results especially the eGFR level, in that some doctors think that the eGFR itself is an unreliable parameter in diagnosing CKD. Subsequently, there is a practice of referral to secondary care amongst some physicians to establish the diagnosis due to a lack of confidence and

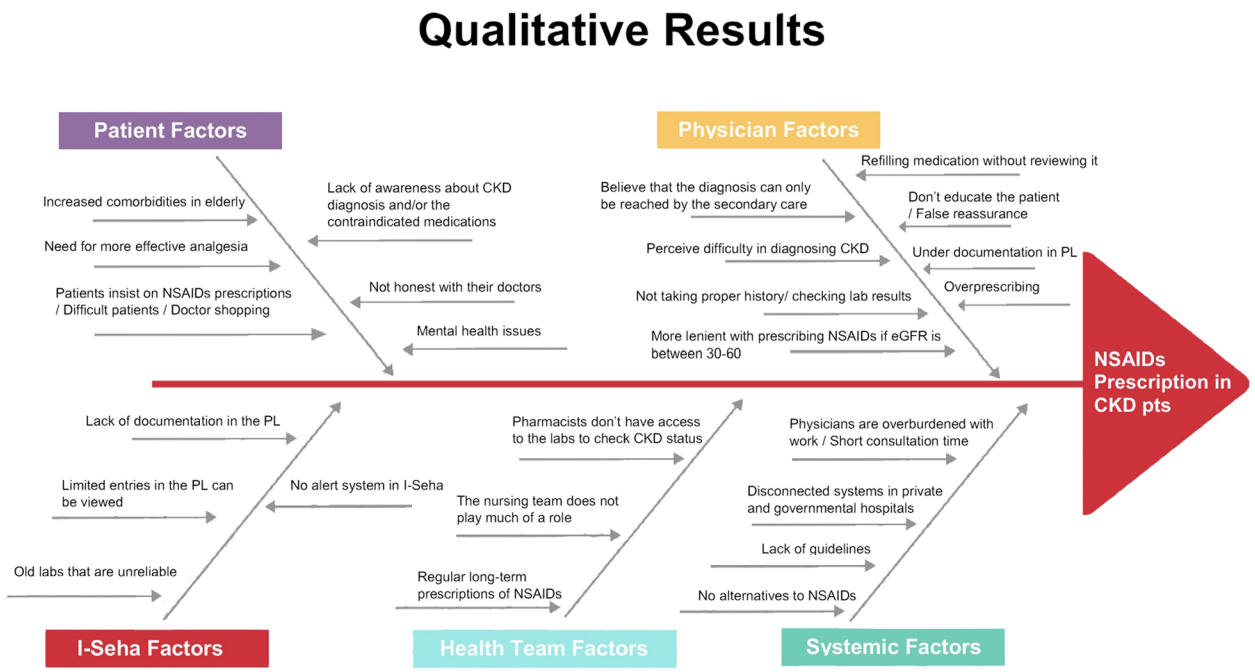

Fig. 1 Thematic analysis of qualitative data

awareness. A doctor said: "For the diagnosis of CKD we usually refer them for nephrology, and they have to diagnose them there". And when asking about listing CKD in the problem list, a doctor said "No, we don't put this diagnosis. It should be from the nephrology side after referral". However, not all the physicians interviewed shared this lack of confidence in diagnosing CKD. It is important to note that not all physicians practicing in the primary care centers have postgraduate training, which can explain the disparity in the clinical skills amongst the physicians interviewed.

Furthermore, some doctors find it acceptable to prescribe NSAIDs for CKD patients in certain situations, for example, if the eGFR level is between 30–60 mL/min per 1·73 m2 in order to weigh the risk and benefit. However, a doctor insisted that NSAID is not contraindicated in CKD.

Health team factors

The third theme concerns other health care members such as secondary care physicians, nursing team, laboratory department and pharmacists. Some doctors thought that NSAIDs are already being prescribed for longer periods from secondary care. Others think that nurses should be able to recognize CKD patients, be aware about contraindicated medications and notify the PCPs if necessary. A subset of doctors pointed at the pharmacists as not having access to the laboratory test results, so they are not able to assess renal impairment before dispensing potentially nephrotoxic medications. Another point raised was that medications prescribed from primary care are usually dispensed into envelopes that don't include the medication information leaflet.

I-SEHA factors

The I-SEHA system was listed as the fourth theme. Some physicians highly praised the system, while others found it to be one of the biggest contributory factors. Interviewees noted that if the patient has multiple comorbidities, the I-SEHA user interface only allows limited entries to be shown in the summary page's problem list making it more likely that the diagnosis of CKD will be overlooked.

Additionally, the I-SEHA system has an alert system regarding asthma contraindicated medications and allergies. However, there is no alarm that alerts the physicians when prescribing a contraindicated medication to CKD patient. Another point raised is that some patients have old laboratory test results which are not updated and thus deemed unreliable by some physicians who don't trust that these old laboratory results are still accurate at the time of the consultation, so in this case the physician is more likely to prescribe NSAIDs.

System factors

The fifth theme comprises of system factors. Many doctors are overwhelmed with the workload and find that the consultation time is limited. This consequently leads to inadequate history taking, no review of medication

along with poor doctor-patient communication. Some doctors attributed this issue to the lack of CKD national guidelines. While others thought that there were no alternatives for pain management in certain inflammatory conditions such as osteoarthritis. Another contributing factor that was pointed out was the disconnect between hospitals across the country. The private hospitals use a different system than governmental hospitals which prevents doctors from accessing patients' medical records including laboratory test results. As an example, a patient might have impaired kidney function as demonstrated by the eGFR test but if the test was done in a private hospital, the PCP won't be aware of this result. A doctor said, "if he is following in other hospitals like KHUH, BDF, private hospitals the results of his labs investigations doesn't appear in our system".

Proposed solutions

The interviewed physicians offered solutions for solving this issue that were later categorized into five sections:

Solutions relating to the patients

Many physicians stressed the importance of increasing patients' and caregivers' awareness about CKD by educating them about the nature of the disease and the consequences of taking nephrotoxic medications. One doctor emphasized: "there should be better patient education" regardless of where he is being managed, in primary or secondary care. Strategies suggested for raising awareness of patients and the community involved education from the doctors during consultations, providing educational leaflets, educational posters, and social media campaigns.

Solutions relating to the physicians

As for solutions for doctors, increasing awareness of CKD and contraindicated medications is crucial, along with encouraging the documentation of diagnoses in the problem list. As one doctor noted, "If the doctor looks at the list of documented diagnoses or generates the diagnosis of chronic problems, it will alert other doctors." Some physicians recommended adopting a stepwise approach to pain management in CKD patients, emphasizing the importance of prioritizing non-pharmacological modalities when appropriate. Specifically, alternative medicine techniques such as yoga and acupuncture, as well as physiotherapy, should be considered first, as they can provide effective pain relief with a lower risk of nephrotoxicity. This prioritization of alternative therapies can enhance patient safety and improve overall pain management in individuals with CKD.

Solutions relating to health team members

Regarding solutions for the other healthcare team members, a few doctors proposed that nurses should be able to recognize the CKD diagnosis and alert the prescribing doctor if indicated. One doctor suggested that pharmacists should have a role in identifying patients at risk by educating them about possible side effects and providing medication leaflets.

Solutions relating to I-SEHA

When asked about ways to improve the user interface some physicians proposed an alert system that would automatically show the eGFR level when physicians attempt to prescribe medication in the system. One doctor mentioned how this alert system already exists in I-SEHA for conditions such as asthma or when there is serious interaction between two prescribed medications "If they can apply an alert in the system just like for asthma or serious medications interactions it would be good".

Solutions relating to the system

Regarding the lack of alternatives for pain management in primary care such as topical analgesics and pain relief bandages. One doctor stated that if other alternatives were available then "we can offer [patients] other medication other than non-steroidal, we can offer the local treatment for pain like creams, Elastoplast". Some physicians suggested utilizing physiotherapy when appropriate. However, they noticed that patients are usually not satisfied with physiotherapy as sessions are usually scheduled far apart and they deemed them ineffective as pain relief measures.

Additionally, few doctors suggested that the presence of a specialized pain management doctor could be helpful in dealing with patients who have comorbidities and chronic pain. As well as establishing national guidelines for CKD specifically can help with the diagnosis and management in primary care. Another strategy proposed is providing an identity booklet or card that documents patients' chronic illnesses so that doctors can identify CKD patients.

Discussion

This study aims to reduce the number of prescriptions of NSAIDs in the CKD patient population and thereby improve the quality of care provided to patients in primary care. This was based on the assumption that there is a significant rate of NSAIDs prescription in this

population group in Bahrain. The objectives were to measure the prevalence of NSAIDs prescription in the CKD population from the primary care health centers, to estimate the prevalence of CKD documentation in the chronic problem list in the I SEHA system and to explore the barriers/challenges that contribute to this issue from the perspective of primary care physicians. Consequently, there is a hope to suggest feasible solutions to reduce NSAID prescriptions in CKD patients.

The study found that among 4,380 patients, 761 (17.4%) patients had at least one NSAID prescription from primary care. This percentage was found to be less than the prevalence in primary care in southern Italy which had a prevalence rate of 56.3% of at least one NSAID prescription in the CKD population [22]. A possible explanation for the difference in prevalence rates could be the different methodologies used. Although studies relied on electronic health records and prescriptions from primary care; in the Italian study the sample population was based on doctors' documentation of CKD in their health records using ICD- 9 codes, when it is known from the literature that there is poor documentation globally and this brings to question the accuracy of their case definition [24]. While this study used the eGFR laboratory results to get a more precise sample population. This highlights the disparities in defining CKD in studies done around the globe and how that ultimately affects the outcome. However, the prevalence rate of 17.4% closely mirrors findings from a study done in the Kingdom of Saudi Arabia that studied the potentially inappropriate medications (PIMs) being prescribed to the elderly population (defined as above 60 years of age), and they found that NSAIDs were the second most used PIMs at 17.2% [12]. The Saudi study had a different methodology as their population was the elderly and it included prescriptions from both the primary and the secondary care. Regardless, the similarity in prevalence rates could be explained by the fact that the populations of Bahrain and Saudia Arabia share genetic, familial, cultural and religious ties.

The differences from one study to another can also be attributed to genetic variations which may contribute to individual differences in the susceptibility of patients to NSAID-induced nephrotoxicity. Various genes contribute to the systemic inflammatory response, with TNF-α being particularly influential in determining the severity of tissue damage. Genetic variations can also impact the kidney's response to injury, affecting the likelihood of developing a more severe condition or recovering. In the context of NSAID-induced nephrotoxicity, genetic factors can influence drug metabolism in the kidneys, potentially altering drug concentrations and increasing the risk of adverse renal effects. Understanding these genetic factors may help identify patients who are predisposed to developing kidney problems when taking NSAIDs [25, 26].

One must keep in mind that in the Gulf Co-operation Council (GCC) Countries such as Bahrain and Saudi Arabia, patients can easily obtain NSAIDs from private hospitals, secondary care hospitals, over the counter medications and even from friends or family members.

Furthermore, in looking at the prevalence of CKD documentation in the chronic problem list in the I-SEHA system surprisingly, only 14 patients of the total population had their CKD diagnosis documented in the system which represents a percentage of 0.3%. Bearing in mind that the documentation of a CKD diagnosis can be done by both the secondary and primary care health providers, this percentage does not reflect the practices of the primary care physicians. The lack of documentation may be explained by doctors' uncertainty in diagnosing CKD in primary care or a lack of documentation overall. However, such issues exist globally and are not limited to Bahrain; studies showed that there might be a lack of awareness of CKD diagnosis by physicians [14]. This could be explained by a cross-sectional observational study which found that documentation of CKD diagnosis on the electronic problem list was rare and only 16% of patients had the diagnosis recorded [27]. Nevertheless, our results found that CKD documentation was not significantly related to NSAID prescription (p-value 0.312). This could be explained by the fact that such a low number of patients had their diagnosis documented, so it's difficult to draw conclusions from such limited data. This finding contradicts a study in the literature that found increasing documentation of CKD may improve stage-appropriate monitoring [27]. Another study done in primary care in the US showed that increased documentation of CKD helped CKD patients achieve "treatment goals more frequently than patients without documented CKD" [22]. Thus, the literature supports increasing documentation of CKD to improve overall patient care.

These 4,380 CKD patients were categorized into two groups according to age: adults younger than 65 years of age, and elderly who are 65 years and older. This categorization was chosen after looking at the distribution of ages and taking the median age into account. This was also backed up by the literature review in which several studies exclusively studied NSAIDs prescriptions in the elderly [12]. It must be briefly noted that with increasing age, the accuracy of kidney function testing including eGFR testing is affected due to physiological age-related changes in the kidneys, decreased creatine levels due to decreased muscle mass, and may also be affected by multiple medications used and various co-morbidities [28].

According to the results of this study, patients younger than 65 years (adults) were more likely to receive NSAIDs than patients older than 65 years (elderly) with a rate of 19.3% to 16.2% respectively with a statistically significant difference (p-value = 0.008).

In addition to that, patients with more severe renal impairment (measured as an eGFR level of less than 30) were less likely to be prescribed NSAIDs in comparison to patients with moderate renal impairment, and this difference was statistically significant (p-value of 0.001).

This is unlike other demographics such as gender and nationality, which were found to be insignificant. A possible explanation as to why age and lower eGFR level play such an important role in the prescribing practices of PCPs is that doctors might have default biases about the different age groups. Habitually, physicians view elderly patients as more vulnerable and more likely to have CKD. This unconscious bias could inadvertently lead them to be more cautious and careful about prescribing NSAIDs and vice versa be more lenient with younger patients. Another reason for this finding could be that younger patients are less likely to be aware of their diagnosis as they naturally have fewer co-morbidities, so they might be oblivious to the fact that they need to present it to the doctor's attention especially if doctors rely on patients' history giving.

In addition, physicians are more cautious about prescribing NSAIDs in those patients with severe renal impairment. The literature also supports this, where an international practice guideline illustrates that there's a gray zone where NSAIDs can be prescribed according to the eGFR level. It recommends "complete NSAID avoidance in patients with a glomerular filtration rate (GFR) < 30 mL/min/1.73 m2 and avoidance of prolonged use in patients with a GFR < 60 mL/min/1.73 m2" [6]. Another explanation could be found from a study done in England that found patients with more severe renal impairment of eGFR 30–44 to be "more likely to be aware of their diagnosis" [29]. Therefore, these patients are more likely to inform their physicians of their diagnosis and avoid contraindicated medications like NSAIDs. Nevertheless, this study found that 98 patients with eGFR < 30 were still being prescribed NSAIDs in the primary care. This means that patients with more severe renal impairment are still at risk of receiving NSAIDs, which could be intentional – as some doctors weigh the risk and benefits – or it could be due to negligence.

Furthermore, physicians shared that they had trouble interpreting renal function tests while others found eGFR to be an unreliable parameter when it comes to the diagnosis of CKD. This is consistent with the systematic review that found that physicians have difficulty in recognizing a CKD diagnosis which leads to minimizing the seriousness of the condition [14]. Consequently, this can lead to over-referral to secondary care to diagnose patients. The CKD definition is internationally recognized as mentioned previously and the "Kidney Disease Improving Global Outcomes 2012 clinical practice guideline" encourages the use of standardized diagnostic tests – eGFR – for diagnosing CKD [11, 22]. Moreover, a short interview was conducted with the head of internal medicine at Arabian Gulf University in the Kingdom of Bahrain who had vast training experience in nephrology to further delve into the issue of CKD diagnosis. He reiterated that eGFR can be used as a reliable parameter to diagnose CKD considering the internationally recognized definition.

A few physicians stated that it's acceptable to prescribe NSAIDs in certain scenarios after weighing the risks and benefits especially when the eGFR level was between 30 to 60 L/min/1,73 m^2.An international practice guideline recommends avoidance of prolonged use if the eGFR was < 60 L/min/1,73 m^2 and complete avoidance if the eGFR was < 30 L/min/1,73 m^2 [6].

As for the health team factors, some physicians stressed that nurses and pharmacists should be able to recognize CKD diagnosis and prevent administering or dispensing potentially nephrotoxic medications. In addition, the practice of OTC can be further aggravated by the pharmacists'neglect of patients'medical history before dispensing medications. One study showed that NSAIDs were being given by pharmacists to CKD patients [6].

As for I-SEHA factors, some physicians perceived it as being not user-friendly. Moreover, the system is flawed as it doesn't have a safety net that can prevent the prescription of inappropriate medications in CKD.

The last theme was system factors, many doctors expressed their discontent with the allocated consultation time and found it insufficient to review the patients'medical files and communicate important details about their disease and management. This was similar to the study which attributed inappropriate prescriptions to short consultation time [14]. Another major contributing factor could be the lack of a national guideline for CKD that advises on diagnosis, management, and referral indications. This was also seen in a qualitative study where some PCPs felt they lacked CKD management skills due to lack of clinical practice guidelines [14]. The disconnect between different types of hospitals in Bahrain can further exacerbate the issue of inappropriate prescriptions. A patient might already be diagnosed with CKD and follow up in a hospital but later goes to their designated primary health center which does not have all his medical files.

The proposed solutions

In addition to identifying factors contributing to inappropriate prescriptions, physicians interviewed emphasized the need to raise patient and caregiver awareness about chronic kidney disease (CKD) and contraindicated medications. This could be achieved through one-on-one education during consultations, educational materials, social media, and health campaigns.

Physicians also suggested enhancing their education regarding CKD diagnosis and management in primary care. A study in Derby found that most CKD patients could receive care in primary settings, with only 6% needing nephrology referrals [29]. Similarly, a cohort study from Alberta recommended further training for primary care physicians (PCPs) on pain management in CKD [30].

To improve team collaboration, educating nurses about CKD and nephrotoxic medications is crucial. Nurses can alert physicians about patients'CKD status and contraindications. Pharmacists can play a role in educating patients about medications and conducting medication reviews across clinical settings [31].

Improving the I-SEHA system by introducing CKD-specific alerts to prevent inappropriate prescriptions is another recommendation. This system already exists for conditions like asthma, indicating it is feasible and could reduce NSAID prescriptions in CKD. Studies highlight that electronic communication and automated eGFR reporting enhance CKD identification and management [32, 33].

Regarding system solutions, physicians proposed alternative pain relief methods for CKD patients, such as topical analgesics, physiotherapy, and acupuncture. However, the lack of available topical analgesics and the infrequency of physiotherapy sessions can hinder effective pain management.

Finally, establishing national guidelines for CKD is essential. This aligns with a study indicating that addressing care gaps through intensive training for PCPs and risk-based nephrology referrals is critical [14]. Additionally, a proposed solution for managing patient histories across different hospitals in Bahrain is to issue identity booklets or cards documenting chronic illnesses.

In summary, it is essential to increase awareness of CKD and involves patients, PCPs, and health team members to ensure appropriate medication practice. An automated eGFR reporting system or Computerized clinical decision support systems (CCDSS) can be established to help with this issue. Moreover, establishing a national guideline is imperative for ensuring pertinent CKD management.

Limitations

Finally, several limitations were illustrated in the process of this study. The one-year duration of the study may have inadvertently caused the exclusion of patients that were diagnosed with CKD (impaired kidney function for more than 3 months) at the beginning or at the end of the study period, consequently reducing the population size. In addition, CKD patients were not interviewed and only the perspective of physicians was considered. Naturally, that will skew the results to the benefit of physicians and place the blame more on the patients. Secondly, over-the-counter medications and medications that have been prescribed by the private sector or other governmental hospitals were not studied, so our findings only represent the tip of the iceberg concerning the issue of NSAIDs prescription in CKD patients and only represent the prescription practices in primary care. However, these limitations do not detract from the findings of this study.

Conclusion and recommendations

In conclusion, this research measured the inappropriate prescription of NSAID in CKD in the Kingdom of Bahrain which is 17.4%. And since there were no previous studies done locally, this study provides important information to decrease the gap in knowledge and to improve the quality of services provided by primary health care in Bahrain. It also discovered the potentially contributory factors behind NSAID prescription which were categorized into five themes.

Finally, researchers recommend increasing PCPs' awareness of CKD diagnosis and contraindicated medications in primary care centers. This can be achieved by establishing national guidelines that would help to keep PCPs updated. In addition, patient and community education regarding the disease itself and the contraindicated medications would play an important role in addressing this problem. Furthermore, to establish a Swiss cheese model that involves patients, PCPs, and other health team members especially nurses and pharmacists to prevent the prescription of contraindicated medications and increase patient safety. This could be done by encouraging documentation of CKD in the problem list. Another approach would be modifying the I-SEHA system, where physicians would be alarmed when prescribing NSAIDs to a patient with an eGFR level of less than 60 L/min/1,73 m^2.

Since there is no previous study done in Bahrain that addresses NSAIDs prescription in CKD, further studies should be conducted to explore the problem further. One could study the issue of NSAID prescriptions from the perspective of CKD patients with qualitative interviews, which would add another dimension to the problem at hand. Another suggestion for a future study is following

the progression of CKD disease in relation to NSAIDs prescribed, and whether the eGFR worsens with time.

Abbreviations

NSAID	Non-steroidal anti-inflammatory disease
CKD	Chronic kidney disease
eGFR	Estimated glomerular filtration rate
EMR	Electronic medical record
PCP	Primary care physician

Supplementary Information

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Supplementary Material 1.

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Authors' contributions
WH played a vital role in this research. She conceptualized the study, designed the methodology, collected patient data, performed data analysis, and interpreted the results. WH also contributed to writing and editing the manuscript and participated in the review and approval process. RM, AA, FA, BM WH played a key role in conceptualizing the study and designing the methodology. They also collected patient data and performed data analysis. SH played a role in designing the work and analyzing the data. SC played an important role in analyzing data and interpreting the results. OA played a key role in designing the study methodology and editing the introduction section. MS played a crucial role as the supervisor. He provided guidance and oversight throughout the entire proves. He actively participated in various aspects of the study including study design, data analysis, and interpretation of the result. All authors read and approved the final manuscript.

Data availability
The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request (walaa-hadi@outlook.com).

Declarations

Ethics approval and consent to participate
For the quantitative part: the confidentiality of the patients and their personal information will not be disclosed. All data collectors and researchers signed a form that commits them to withhold sharing any patient information. Informed consent was obtained from all participants and their legal representatives.
For the qualitative part: oral consent was taken from the participating physicians, and they were informed about the study aims and objectives. They remained anonymous and their participation in the study was voluntary and they can withdraw if they wish to do so at any point. They were informed that the interviews would be recorded.
Ethical approval was taken from the research and ethics committee at Arabian Gulf University (E06-PI- 11–22).
It is unlikely that any form of harm (psychological, social, physical, legal) will come to the participating parties as none of their personal information will be revealed.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Clark-Cutaia MN, Rivera E, Iroegbu C, Arneson G, Deng R, Anastasi JK. Exploring the evidence: symptom burden in Chronic Kidney Disease. Nephrol Nurs J. 2022;49(3):227–40.
2. Alshammari B, Noble H, McAneney H, Alshammari F, O'Halloran P. Factors associated with burden in caregivers of patients with end-stage kidney disease (A Systematic Review). Healthcare. 2021;9(9):1212.
3. Khan SS, Kazmi WH, Abichandani R, Tighiouart H, Pereira BJG, Kausz AT. Health care utilization among patients with chronic kidney disease. Kidney Int. 2002;62(1):229–36.
4. Nderitu P, Doos L, Jones PW, Davies SJ, Kadam UT. Non-steroidal anti-inflammatory drugs and chronic kidney disease progression: a systematic review. Fam Pract. 2013;30(3):247–55.
5. Whelton A. Nephrotoxicity of nonsteroidal anti-inflammatory drugs: physiologic foundations and clinical implications. Am J Med. 1999;106(5):13S-24S.
6. Lefebvre C, Hindié J, Zappitelli M, Platt RW, Filion KB. Non-steroidal anti-inflammatory drugs in chronic kidney disease: a systematic review of prescription practices and use in primary care. Clin Kidney J. 2020;13(1):63–71.
7. Heleniak Z, Cieplińska M, Szychliński T, Rychter D, Jagodzińska K, Kłos A, et al. Nonsteroidal anti-inflammatory drug use in patients with chronic kidney disease. J Nephrol. 2016;30(6):781–6.
8. Liew TM, Lee CS, Goh SKL, Chang ZY. The prevalence and impact of potentially inappropriate prescribing among older persons in primary care settings: multilevel meta-analysis. Age and Ageing. 2020;49(4):570–9.
9. Bilge U, Sahin G, Unluoglu I, Ipek M, Durdu M, Keskin A. Inappropriate use of nonsteroidal anti-inflammatory drugs and other drugs in chronic kidney disease patients without renal replacement therapy. Ren Fail. 2013;35(6):906–10.
10. Adams RJ, Appleton SL, Gill TK, Taylor AW, Wilson DH, Hill CL. Cause for concern in the use of non-steroidal anti-inflammatory medications in the community -a population-based study. BMC Family Practice. 2011;12(1):70.
11. Abd ElHafeez S, Hegazy R, Naga Y, Wahdan I, Sallam S. Non-steroidal anti-inflammatory drugs among chronic kidney disease patients: an epidemiological study. J Egypt Public Health Assoc. 2019;94(1):8.
12. Yasky A, Zawawi A. Characterization of potentially inappropriate medication prescriptions for the elderly in primary care and hospital settings. Journal of Family Medicine & Primary Care. 2021;10(8):3111–5.
13. Lin SX, Phillips T, Culliford D, Edwards C, Holroyd C, Ibrahim K, et al. Characterising risk of non-steroidal anti-inflammatory drug-related acute kidney injury: a retrospective cohort study. BJGP Open. 2022;6(1):BJGPO.
14. Neale EP, Middleton J, Lambert K. Barriers and enablers to detection and management of chronic kidney disease in primary healthcare: a systematic review. BMC Nephrol. 2020;21(1):1–17.
15. Bezabhe WM, Kitsos A, Saunder T, Peterson GM, Bereznicki LR, Wimmer BC, et al. Medication prescribing quality in australian primary care patients with chronic kidney disease. J Clin Med. 2020;9(3):783.

16. Whitner J, Fabiili N, Siewart J, Akasaka K, Nelson A. Pharmacist-Led provider education on inappropriate NSAID prescribing rates. Fam Med. 2020;52(8):592–6.
17. Ho KY, Cardosa MS, Chaiamnuay S, Hidayat R, Ho HQT, Kamil O, et al. Practice Advisory on the Appropriate Use of NSAIDs in Primary Care. J Pain Res. 2020;3(13):1925–39.
18. Baker M, Perazella MA. NSAIDs in CKD: Are They Safe? Am J Kidney Dis. 2020;76(4):546–57.
19. Avalos-Mejia A, García-Cruz JC, Escobedo de la Peña J, Garrido-Acosta O, Juárez-Cedillo T. Reduction of inappropriate prescriptions in older adults through the support of Asynchronous Geriatric Counseling Online (AGAlink): Implemented in primary care. PLoS ONE. 2021;16(11):1–12.
20. Bahrain. 2015. Available at: https://www.healthdata.org/bahrain. Accessed 18 Jul 2022.
21. Kidney Disease in United Kingdom. Available at: https://www.worldlifeexpectancy.com/united-kingdom-kidney-disease. Accessed 18 Jul 2022.
22. KDIGO. Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. 2013. Available from: https://kdigo.org/wp-content/uploads/2017/02/KDIGO_2012_CKD_GL.pdf. Accessed 5 Oct 2024.
23. Johansen KL, Chertow GM, Gilbertson DT, Herzog CA, Ishani A, Israni AK, et al. US renal data system 2021 annual data report: epidemiology of kidney disease in the United States. Am J Kidney Dis. 2022;79:A8–12.
24. Ingrasciotta Y, Sultana J, Giorgianni F, Caputi AP, Arcoraci V, Tari DU, et al. The Burden of Nephrotoxic Drug Prescriptions in Patients with Chronic Kidney Disease: A Retrospective Population-Based Study in Southern Italy. PLoS ONE. 2014;9(2):e89072.
25. Ortega-Loubon C, Martínez-Paz P, García-Morán E, Tamayo-Velasco Á, López-Hernández FJ, Jorge-Monjas P, Tamayo E. Genetic Susceptibility to Acute Kidney Injury. J Clin Med. 2021;10(14):3039. https://doi.org/10.3390/jcm10143039. PMID: 34300206; PMCID: PMC8307812.
26. Džidić-Krivić A, Sher EK, Kusturica J, Farhat EK, Nawaz A, Sher F. Unveiling drug induced nephrotoxicity using novel biomarkers and cutting-edge preventive strategies. Chem Biol Interact. 2024;388:110838. https://doi.org/10.1016/j.cbi.2023.110838.
27. Samal L, Linder JA, Bates DW, Wright A. Electronic problem list documentation of chronic kidney disease and quality of care. BMC Nephrol. 2014;15(1):1–15.
28. Muglia L, Di Dio M, Filicetti E, Greco GI, Volpentesta M, Beccacece A, Fabbietti P, Lattanzio F, Corsonello A, Gembillo G, Santoro D, Soraci L. Biomarkers of chronic kidney disease in older individuals: navigating complexity in diagnosis. Front Med (Lausanne). 2024;11(11):1397160. https://doi.org/10.3389/fmed.2024.1397160.PMID:39055699;PMCID:PMC11269154.
29. McIntyre NJ, Fluck R, McIntyre C, Taal M. Treatment needs and diagnosis awareness in primary care patients with chronic kidney disease. Br J Gen Pract. 2012;62(597):e227–32.
30. Armstrong MJ, Zhang K, Ye F, Klarenbach SW, Pannu NI. Population-Based Analysis of Nonsteroidal Anti-inflammatory Drug Prescription in Subjects With Chronic Kidney Disease. Can J Kidney Health Dis. 2023Jan;18(10):20543581221149620.
31. MacRae C, Mercer S, Guthrie B. Potentially inappropriate primary care prescribing in people with chronic kidney disease: a cross-sectional analysis of a large population cohort. Br J Gen Pract. 2021;71(708):e483–90.
32. Weddle SC, Rowe AS, Jeter JW, Renwick RC, Chamberlin SM, Franks AS. Assessment of Clinical Pharmacy Interventions to Reduce Outpatient Use of High-Risk Medications in the Elderly. J Manag Care Spec Pharm. 2017;23(5):520–4.
33. Johnson DW, Jones GRD, Becker GJ, Mathew TH. Automated reporting of eGFR: a useful tool for identifying and managing kidney disease. Med J Aust. 2009;190(4):200–3.

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