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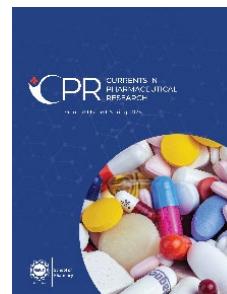
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Title: Assessment of Knowledge, Attitudes, and Perceptions of Community Pharmacists Regarding Vitamin D and Calcium Products: A Qualitative Study in Islamabad and Rawalpindi, Pakistan

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Assessment of Knowledge, Attitudes, and Perceptions of Community Pharmacists Regarding Vitamin D and Calcium Products: A Qualitative Study in Islamabad and Rawalpindi, Pakistan

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ABSTRACT

The current study explored the level of knowledge, attitudes, and perceptions of community pharmacists concerning the usage of vitamin D and calcium products, employing a qualitative approach in the twin cities of Rawalpindi and Islamabad, Pakistan. Calcium, an equally important mineral, contributes to various physiological processes, including blood pressure regulation, prevention of hypertensive complications during pregnancy, and reduction in cholesterol levels. According to the Pakistan National Nutrition Survey 2018, a significant proportion of urban women of reproductive age suffer from hypocalcemia and vitamin D deficiency. This qualitative investigation involved semi-structured interviews with community pharmacists from Islamabad and Rawalpindi, selected through purposive sampling technique. Thematic analysis was used to interpret the collected data. Pharmacists exhibited mixed levels of awareness regarding the benefits and side effects of calcium and vitamin D supplements. While most acknowledged their role in maintaining bone health and potential side effects, only about half were familiar with drug interactions. A generally favorable attitude was observed towards supplementation. The study highlighted that, although community pharmacists in Pakistan have a basic understanding of calcium and vitamin D supplementation, their knowledge and communication practices vary. They show a positive attitude towards their roles, however, often rely on reactive patient engagement.

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Strengthening pharmacist training, policy support, and public awareness is essential to effectively address widespread micronutrient deficiencies.

Keywords: calcium supplementation, community pharmacy, qualitative research, vitamin D

1. INTRODUCTION

Vitamin D, a fat-soluble nutrient, is important to facilitate the absorption of calcium and phosphate, which are essential to maintain healthy bones [1]. Likewise, calcium is a key micronutrient with a broad range of physiological functions. These include reducing hypertensive conditions, regulating cholesterol levels, and preventing bone-related diseases, such as osteoporosis [2, 3]. Common dietary sources of vitamin D include fish, mushrooms, egg yolks, fish liver oils, beef liver, dark chocolates, and dairy-based products, with supplementation commonly prescribed to achieve optimal levels [4]. Current recommendations suggest a daily intake of at least 800 IU of cholecalciferol (vitamin D3) and 1000–1200 mg of calcium to sustain bone health [5].

Globally, vitamin D deficiency has been associated with numerous chronic illnesses including autoimmune disorders, such as multiple sclerosis and rheumatoid arthritis, as well as diabetes, cardiovascular diseases (CVDs), and various cancers [6–11]. Additionally, deficiencies in vitamin D have been linked to conditions, such as rickets, depression, chronic fatigue, obesity, hyperparathyroidism, and osteomalacia [12]. Calcium deficiency remains a pressing health concern worldwide, manifesting clinically through osteoporosis, increased fracture risk, dry skin, brittle nails, muscle cramps, seizures, and neuromuscular symptoms, such as tetany and hyperreflexia [13, 14].

Epidemiological data highlights the widespread occurrence of osteoporosis in developed nations, with U.S.-based studies indicating that 36% of adults and 57% of medical patients suffer from calcium deficiency [15, 16]. Similarly, elevated rates of both calcium and vitamin D deficiency have been documented in low- and middle-income countries including India, Nepal, and Bangladesh [17–19]. In Pakistan, the 2018 National Nutrition Survey reported a high prevalence of vitamin D deficiency, particularly among urban-dwelling women and children [13].

Community pharmacists are well-positioned to contribute significantly to public health through medication counseling and patient education.

However, their potential is often limited by a lack of specialized training, inadequate time, and limited engagement with continuing professional development [20, 21]. This study investigated the current state of knowledge, perceptions, and attitudes among community pharmacists in Pakistan concerning the use of vitamin D and calcium supplements. Furthermore, it also aimed to identify the existing gaps as well as proposed targeted interventions for improved healthcare outcomes.

2. METHODOLOGY

2.1. Study Design

A qualitative study design was implemented to explore the understanding and viewpoints of community pharmacists concerning the utilization of calcium and vitamin D supplements. The research was conducted within the twin cities of Rawalpindi and Islamabad, Pakistan. Rawalpindi and Islamabad were selected as study sites since these cities are the major urban centers with a high concentration of community pharmacies. Due to their diverse population and accessibility, the twin cities are ideal to capture a broad range of pharmacists' perspectives in an urban Pakistani context.

2.2. Participants and Sampling

The participant pool consisted of registered community pharmacists employed in retail pharmacies. Eligibility criteria for pharmacists included a valid license from the Pharmacy Council of Pakistan. Community pharmacies were selected through purposive sampling, using lists acquired from the District Health Office (DHO). Sampling continued until thematic saturation was reached. Thematic saturation was determined when no new themes or sub-themes emerged from the data. This point was reached after the 13th interview and two additional interviews were conducted to confirm saturation. In total, 15 pharmacists participated in the study.

2.3. Interview Guide and Data Collection

A semi-structured interview guide was developed in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) and pilot-tested for clarity. Face-to-face interviews were conducted in a private space within each pharmacy, lasting between 20–30 minutes. Interviews were audio-recorded with informed consent and supplemented by field

notes to capture contextual details. Strict measures were taken to ensure participant confidentiality and privacy.

2.4. Data Analysis

Audio recordings were transcribed verbatim and data were analyzed thematically to extract key themes and patterns.

2.5. Ethical Considerations

Ethical approval for the study was obtained from the Ethics Review Committee of Hamdard University, Pakistan. All participants were briefed about the study objectives and procedures as well as provided written informed consent. Anonymity and data confidentiality were maintained throughout the research process.

3. RESULTS

Among the 15 interviewed pharmacists, 53.3% were males and 46.7% were females. The majority (93.3%) resided in urban areas. Most respondents held a Doctor of Pharmacy (Pharm-D) degree and reported 1–10 years of professional experience, typically working 6 to 8 hours per day in community settings (Table 1).

Table 1. Demographic Characteristics of Community Pharmacists

Demographic	<i>n</i> (%)	
Age (years)	20-30 y	11(73.3)
	31-40 y	4(26.7)
Gender	Male	8(53.3)
	Female	7(46.7)
Experience in Years	<1	1(6.7)
	1-10 years	14(93.3)
Level of Qualification	Pharm D	10(66.7)
	M. phil.	5(33.3)
Working Organization	Urban	14(93.3)
	Rural	1(6.7)
Service Hours	6 hours	4(26.7)
	8 hours	11(73.3)
Number of Prescriptions Per Day	1-10	6(40.0)
	11-20	8(53.3)
	20-30	1(6.7)

The inductive thematic analysis revealed 2 major themes related to Knowledge and attitude of pharmacists about Vitamin D and Calcium Supplements.

3.1. Theme 1: Knowledge about Vitamin D and Calcium Supplements

3.1.1. Understanding and Awareness. Pharmacists displayed varying degrees of knowledge regarding vitamin D and calcium supplements. While some admitted limited awareness, often relying on prescription patterns, others demonstrated a more informed understanding of these products' roles in maintaining bone health and disease prevention.

Some interview excerpts are given below to explain the point: “Yes, I have very little information about calcium and vitamin D supplements. I know these supplements, calcium and vitamin D, are used on a daily basis” (Ph11).

Yes, I have sufficient information about calcium and vitamin D supplements. Calcium and vitamin D supplements are being used for different diseases. Vitamin D supplements are used in major chronic diseases like Diabetes, Hypertension, and Stroke. Patients also have vitamin D deficiency; in those patients, vitamin D injectables are used. Due to vitamin D deficiency, one uses vitamin D supplements. Calcium plays a big role in the absorption of vitamin D. One can use vitamin D supplements if there is a requirement. There are different dosage forms of supplements available in the market including tablets, capsules and injections. (Ph. 13)

3.1.2. Efficacy of Supplements. Pharmacists expressed mixed perspectives on the efficacy and safety of vitamin D supplements, emphasizing that effectiveness is closely tied to appropriate dosing. Several participants acknowledged that while vitamin D is generally beneficial and may help to improve bone health and body function.

Yeah, I can say that in any case, either in pathological case or in a normal person diet, they help a lot. Also, in preventing disease conditions from getting worse and in improving a normal person's health. Yes, they are effective, I can say. (Ph 3)

So, basically, vitamin D and calcium are important nutrients that are very good for bone health and body function. Vitamin D is essential for calcium absorption and helps in the remodeling of bones.

Vitamin D is also very fruitful for bone health and body function. Vitamin D is also very beneficial to avoid bone fractures which increases the calcium absorption rate. Both are efficient and effective in terms of bone health and body function. Vitamin D is also very beneficial for bone health and body function. Vitamin D is essential for calcium absorption, and calcium helps in bone rebuilding. The lower the dosage, the higher the absorption rate of calcium and vice versa (Ph 15).

Some pharmacists highlighted the importance to assess individual patient factors, such as calcium levels and potential allergies before recommending supplementation to avoid complications. However, a few participants demonstrated limited knowledge or uncertainty regarding adverse effects, suggesting a gap in awareness that may impact the perceived safe use and efficacy of vitamin D in community practice. Overall, while many recognized the potential benefits of supplements, their responses underscored the need for better guidance and education to ensure its effective and safe use.

3.1.3. Safety and Adverse Reactions. Although pharmacists demonstrated awareness about common side effects, such as gastrointestinal disturbances and renal complications, some of them expressed knowledge gaps in this area. However, most of them related the side effects with dose.

“It depends on doses, if the dose is high, some adverse effects may occur in patients, such as bloating, flatulence, gastric issues, gastrointestinal infections, and other issues” (Ph 15).

While several respondents displayed familiarity with common side effects, others admitted to having only limited knowledge or no awareness of adverse effects. This reflects a noticeable gap in safety-related understanding among community pharmacists.

“I do not know about such adverse effects because supplements mostly have no side effects” (Ph 9). “No, I don't have any knowledge related to the adverse effects of calcium and vitamin D” (Ph 4).

3.1.4. Dosage and Administration. Community pharmacists demonstrated a general awareness of various dosage forms and administration routes for vitamin D and calcium supplements. This highlights that these vary based on patient needs, age, and clinical

conditions. Participants noted the availability of supplements in oral forms, such as tablets, syrups, and chewables, as well as injectable formulations, with oral administration being the most common and often recommended with food to enhance absorption.

Basically, the dosage is available in different forms, depending on the needs of the patient. Different dosage forms of calcium are available in different strengths, such as 500 mg, 600 mg, and 1000 mg in different brands, and its administration is basically through oral route. It is also available in chewable form. You can also crush it and take it with water. It is preferable to take it with food. We recommend patients to take it with food because their absorption is good. Then dosage and administration are also done, and if we talk about its indications, it has different indications in different groups; it depends on its dose. (Ph 15)

Dosages mentioned ranged from standard daily requirements (e.g., 10–20 micrograms for adults, 400 IU for infants) to high-dose prescriptions (e.g., 2000 IU or more) based on patient condition or physician guidance. Some pharmacists also acknowledged the importance of timings and dietary interactions, particularly for calcium intake. Moreover, its necessity during specific life stages, such as pregnancy and breastfeeding was also emphasized. While the overall understanding of dosage and administration appeared adequate, the depth of knowledge varied among respondents, indicating room for more standardized training and guidance in this area.

The first thing I would like to mention is calcium. It should not be taken with other supplements. For example, meat should not be taken with iron-rich foods or supplements. Calcium should be specifically taken at specific times of the day, as advised according to your condition. And adults who are between the ages of 19 and 64 or over need 700 mg of calcium a day, which cannot be fulfilled with their diet or with food, so we need a supplement. But you should get your proper diet, preferably with your daily diet. When coming towards vitamin D, mostly vitamin D and calcium are taken together as well because vitamin -D helps to regulate calcium and phosphate amounts in the body. The dose of vitamin D in adults, yeah, and also in children, if they are older than one year, they can take, or you can say they need, 10 to 20 micrograms of vitamin D a day. And, for the infants up to the age of one year, they need daily

400 IU of vitamin D. You can take vitamin D in syrup forms, in tablet forms, and as chewable tablets for kids as well. And you can find any form that suits your children, yourself, or your elderly relatives or patients. Breastfeeding women must take calcium every day. And it helps with various physiological processes and bodily changes. Apart from all multivitamins, calcium is the most important for pregnant and breastfeeding women as well. They should take it every day as part of their normal diet. (Ph 3)

3.1.5. Drug Interactions and Contraindications. Roughly half of the pharmacists were able to identify potential interactions with antibiotics, gastrointestinal agents, and antacids, as well as contraindications in patients with hypertension or renal impairment.

“Calcium interacts with medicines like tetracycline and antacids. It is not given to them because it affects their absorption. So, their drug-drug interaction occurs between them. Most kidney patients are not given vitamin D or calcium” (Ph 1).

A few pharmacists emphasized that such supplements should be used cautiously by patients with renal insufficiency, hypertension, or diabetes due to risks, such as calcium deposits, renal calculi, and metabolic disturbances. Some also noted the need to monitor for conditions, such as hypercalcemia and hypervitaminosis, particularly in cases of overdose.

Vitamin D prevents the absorption of tetracycline by antibiotics. It is said that antibiotics and calcium should not be taken together or with dairy products. Similarly, we do not take calcium with anticoagulants like warfarin. The diuretics in our body reduce calcium levels. Vitamin D is also reduced. So, with diuretics, it is indicated that you should take calcium supplements. Apart from this, kidney patients have calcium deposits and hyperkalemia can occur. Stones can form. The metabolism of patients suffering from kidney-related problems is not good. So, the vitamin D level can increase due to a lack of metabolism. I think we should take it cautiously with diabetic medicines. (Ph 14)

However, a number of participants admitted to have limited or outdated knowledge in this area, relying on digital tools or references when needed. This inconsistency highlights a knowledge gap among community pharmacists regarding drug interactions and contraindications,

underscoring the need for continuous education and clinical decision support tools in practice.

“I don't have enough knowledge related to interactions. And yes, these or other products should be given to patients with renal insufficiency cautiously” (Ph 2).

“To be honest, I don't have sufficient knowledge of these product interactions with other products. I might have given a general overview, but specifically, I do not have sufficient information related to contraindications in these diseases” (Ph 12).

3.2. Theme 2: Attitudes of Pharmacists

3.2.1. Professional Role and Responsibility in Public Health.

Pharmacists recognized the significant impact of vitamin D and calcium supplementation on public health. Particularly, addressing widespread deficiencies among vulnerable populations, such as women, the elderly, and those with poor dietary habits was also documented. Many highlighted the essential role of these supplements in preventing conditions, such as osteoporosis, improving bone strength, and enhancing overall health outcomes.

I have seen patients who were, for example, osteoporosis patients or, especially in women, the calcium is really necessary after the age of 40 because of menopause, I would say, because there is a lot of calcium deficiency in patients and that causes them stress, fatigue, and all those conditions. So, I have personally observed that the women who take calcium products are more active, and they have fewer complaints about their bones and joints pain. So yes, I would agree with this: calcium products do have efficacy in the general population and in disease conditions. (Ph 10)

Participants expressed a strong sense of professional responsibility to educate and guide patients, emphasizing the importance of accurate counselling on dosage, indications, and potential adverse effects. They also acknowledged challenges, such as limited time, patient reliance on physicians, and systemic issues including insufficient collaboration between healthcare providers.

I would strongly agree that a pharmacist should have knowledge about vitamin D and calcium regarding their indications,

contraindications, adverse effects, and side effects. This is because when the patient comes, he doesn't know much, and he doesn't have much knowledge about the adverse effects of calcium. However, there is a common myth in the general Pakistani population that if we take multivitamins, we will get stronger. In fact, we have sufficient knowledge about their adverse effects as well. So, I think pharmacists should guide patients on when and how much to use these products. Yes, if a patient comes to me and asks me about any product that includes vitamin D and calcium, and if they ask me to give them time and let them counsel them, I will have sufficient time for them, explain things, and, you know, take help from the many applications that guide me and provide them with good guidance. (Ph 10)

Despite these barriers, pharmacists advocated for proactive public health strategies—including sun exposure, dietary improvements, and broader awareness campaigns—to address deficiencies. Several also called for greater integration of pharmacists into public health initiatives and emphasized their potential to influence patient behavior through accessible, evidence-based guidance.

Different strategies and policies should be made to spread awareness among people. This is because people have no idea about vitamin D and calcium supplements or how these problems are caused by malnutrition. Awareness is power and it is the responsibility of pharmacists to guide and make people aware. (Ph 15)

3.2.2. Confidence and Communication in Patient Care. Pharmacists demonstrated varying levels of confidence in recommending and dispensing vitamin D and calcium supplements, often shaped by their clinical knowledge, patient history, and brand familiarity. While many felt assured in advising patients, especially when supported by prescriptions or evident deficiency symptoms, others acknowledged a need for improved knowledge and hesitated to make independent recommendations. This confidence was often tied to product quality, as one pharmacist explained, “If it is from a good company or an international company, it will give you the desired effect... but if it is from a local company, I am not sure” (Ph 14). Communication with patients extended beyond basic dispensing to include counseling on dosage, adverse effects, and drug interactions. Pharmacists

stressed the importance of obtaining medical histories and checking for contraindications.

“As a pharmacist, I do ask customers about their medical histories and associated morbidities before recommending any calcium or vitamin D products” (Ph 15).

However, time constraints and patient expectations sometimes limited these interactions. Despite such challenges, pharmacists broadly recognized patient education as integral to their role, with one stating, “Yes, of course. I told them about the adverse effects of these products and commented on what I knew... and guided them completely with what I knew. (Ph 1)

3.2.3. Collaborative and Practical Aspects of Practice. Pharmacists consistently emphasized the importance of vitamin D and calcium supplements being dispensed under professional supervision to ensure safe and effective use. Many expressed that these products should ideally be prescribed and guided by physicians or nutritionists, as they have the expertise to assess individual patient needs, dosage, and potential contraindications. Pharmacists noted the risks of unsupervised self-medication, especially for vulnerable patients with comorbidities, such as kidney issues, underscoring the pharmacist’s role in patient counseling and monitoring.

These products should be recommended, according to the nutritionist, because they have sufficient knowledge of multivitamins as well as nutrition to make a better decision. Yes, it definitely should be dispensed under the supervision of a qualified pharmacist. (Ph 8)

No, I don't think so. I don't think it should be under pharmacy supervision. Dispensers or pharmacist technicians can also dispense it. It should be done according to the prescription. Yes, but it should be dispensed according to the physician's and nutritionist's prescriptions. (Ph 11)

Despite recognizing the commercial aspect where vitamin D and calcium supplements can be a source of profit for pharmacies and sometimes even doctors, many stressed that pricing strategies should be mindful of the socioeconomic diversity in Pakistan. This ensures affordability without compromising efficacy.

Yes, in some pharmacies, it is considered to increase sales. Yes, of course, because there are some brands that are very expensive. So, during prescriptions, what you are giving should be considered. In Pakistan, there are many poor patients. (Ph 1)

There was a perception that some brands, especially international ones, are trusted more due to perceived higher quality, while local brands faced skepticism. Pharmacists acknowledged the need to balance commercial interests with ethical responsibilities in order to prioritize patient health. Overall, collaborative care involving physicians, nutritionists, and pharmacists was viewed as essential to optimize therapeutic outcomes, maintain patient safety, and provide cost-effective treatment options tailored to patients' financial capabilities and health conditions.

4. DISCUSSION

Vitamin D and calcium supplements play a crucial role in preventing and managing a wide range of bone-related and metabolic conditions, particularly in populations where nutritional deficiencies are common. In countries, such as Pakistan, where dietary inadequacies and limited sun exposure contribute to widespread deficiencies, these supplements are frequently recommended to improve overall health outcomes. However, the increased demand for such supplements also raises important considerations related to their accessibility, affordability, and safe use. The current study explored how pharmacists perceive and navigate the practical and collaborative aspects of dispensing vitamin D and calcium products. This highlights the interplay between professional responsibility, economic factors, and the need for interprofessional collaboration with physicians and nutritionists. The findings underscore the importance of pharmacists' involvement in ensuring that these commonly used supplements are dispensed appropriately and ethically, with attention to patient-specific needs and the broader healthcare context.

Furthermore, the findings highlight that community pharmacists in Pakistan possess a basic level of knowledge regarding the use of vitamin D and calcium supplements, particularly in terms of dosage forms, administration routes, and common side effects, such as gastrointestinal discomfort and kidney-related issues. However, the depth and consistency of this knowledge vary significantly among individuals. Some pharmacists showed strong awareness of drug interactions, such as those with

tetracyclines, diuretics, antacids, or antiepileptics, while others admitted relying on online resources, for instance Google or drug apps to fill knowledge gaps.

These findings mirror similar studies from countries, such as Iran, Qatar, and Jordan, where pharmacists demonstrated awareness of the therapeutic role of supplements but lacked comprehensive training on safety, efficacy, and contraindications [22–31]. Notably, in contrast to Saudi Arabia and some Gulf countries, where pharmacists often had more structured training, Pakistani pharmacists face challenges related to inconsistent education and limited access to structured resources [24]. Pharmacists in the study exhibited a generally positive attitude towards their roles in supplement dispensing. They acknowledged their ethical responsibility to counsel patients about proper usage, side effects, and contraindications of these supplements. Majority of them supported the idea that vitamin D and calcium should be prescribed by physicians or nutritionists and dispensed under pharmacist supervision to ensure rational use. However, communication practices varied widely. While some pharmacists offered detailed counseling, checking medical histories and using pharmacy systems to identify potential interactions, others only provided guidance when prompted by a prescription. These inconsistencies are concerning, particularly in a healthcare environment where pharmacists are often the most accessible point of contact for patients.

When compared to practices in high-income countries, such as the United States, Singapore, and Australia, Pakistani pharmacists operate under more constrained systems, with fewer technological tools, limited public trust, and inconsistent education [28–36]. Nevertheless, the positive attitude and willingness to collaborate with physicians and nutritionists shown by Pakistani pharmacists is a promising foundation for improvement. Global literature highlights the importance of pharmacist-patient communication in ensuring medication adherence and safe usage of dietary supplements [33, 35]. In Pakistan, this is essential due to the prevalence of self-medication and limited patient awareness. Multiple factors contribute to the gaps identified in this study. These include a lack of structured continuing education for pharmacists, minimal regulatory enforcement around supplement dispensing, and inadequate public health campaigns promoting awareness of micronutrient deficiencies. Cultural habits, such as preference for physician guidance over pharmacist advice, limited sun

exposure due to indoor lifestyles, and poor dietary habits also play a significant role in perpetuating deficiencies. Additionally, commercial pressures within pharmacies, such as profitability expectations, may discourage thorough patient counseling. Some pharmacists mentioned stakeholder pressure to promote high-cost brands, a factor that may compromise ethical dispensing and objectivity. The findings also align with international concern over the widespread prevalence of vitamin D deficiency, particularly in South Asia. Previous studies have attributed this to metabolic, behavioral, and environmental factors [37, 38], which are highly relevant in the Pakistani context.

4.1. Conclusion

The current study concluded that while community pharmacists in Pakistan possess a foundational understanding of vitamin D and calcium supplementation, their knowledge is not uniform or fully comprehensive. They demonstrate a positive attitude towards their professional responsibilities and recognize the significance of their role in supplement counseling and public health promotion. However, communication practices remain inconsistent and many pharmacists rely on reactive rather than proactive approaches to patient education. The higher prevalence of vitamin D and calcium deficiency in Pakistan underscores the urgent need for national interventions that enhance pharmacist training, improve public awareness, and foster interprofessional collaboration. As the healthcare landscape evolves, the integration of pharmacists into preventive care models would be critical to addressing micronutrient deficiencies and improving overall health outcomes. Progress in this area would require sustained, multi-tiered efforts, ranging from educational reforms and policy regulations to community-based awareness programs. Although change may be gradual, consistent and well-structured interventions can pave the way for a more informed public and a more empowered pharmacy workforce.

CONFLICT OF INTEREST

The authors have no financial or non-financial conflict of interest in this manuscript.

DATA AVAILABILITY STATEMENT

Relevant data generated and analyzed during this study can be obtained from the corresponding author upon request. Access to certain portions of

the dataset may be limited in order to maintain patient confidentiality and comply with institutional guidelines.

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