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Towards safe and effective use of OTC medications for children: Community insights from parents in Al-Baha

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ABSTRACT

Incorrect use of over-the-counter (OTC) medications in children can result in harmful outcomes. This study aimed to assess parental knowledge and practices regarding OTC medication use in Al-Baha, Saudi Arabia. A cross-sectional study was conducted between January and August 2024 using a validated, self-administered questionnaire distributed via social media. Adults aged 18 years and above residing in the Al-Baha region who consented to participate were included. Data were analyzed using SPSS version 25, with knowledge and practice levels classified based on predefined cutoff scores. Pearson's chi-squared test was used to examine associations between sociodemographic factors and knowledge or practice levels, with statistical significance set at $p < 0.05$. A total of 791 participants were included, the majority being female (63.2%) and university graduates (74.7%). While 68.9% demonstrated good knowledge, 88.6% showed poor practice. Higher education was significantly associated with better practice ($p = 0.03$), and gender was significantly associated with knowledge levels ($p = 0.03$). Fever was the most commonly identified indication for OTC medication use (81.5%), yet only 15.4% correctly identified the appropriate paracetamol dosage. Healthcare providers were the primary source of drug information for 74.3% of participants. The findings highlight a clear gap between knowledge and practice, underscoring the need for targeted educational interventions. Community-based education, standardized counseling protocols, culturally appropriate materials, digital tools, and online peer support platforms may enhance the safe use of OTC medications. Continuous feedback on educational resources is essential to ensure alignment with current evidence-based guidelines.

1. Introduction

In contemporary medicine, pain management is a crucial part of patient care. Over the years, various modalities have been employed to alleviate pain, and today we have access to a broad spectrum of pharmacological options. Among the most used are over-the-counter medications, such as paracetamol (acetaminophen) and NSAIDs (non-steroidal anti-inflammatory drugs). These medications are widely accessible due to their efficacy in pain management and their generally favorable safety profiles when used appropriately (Abdel Shaheed et al., 2021; Doria et al., 2021; Peck et al., 2021; Yam et al., 2018).

Paracetamol is a widely used analgesic and antipyretic with centrally acting mechanisms. It is primarily metabolized in the liver, where it produces a toxic metabolite, N-acetyl-p-benzoquinone imine (NAPQI). An overdose of paracetamol can lead to severe hepatic injury (Mazaleuskaya et al., 2015a). In contrast, NSAIDs exert their effects by reducing inflammation. However, an overdose of NSAIDs can result in kidney injury by disrupting prostaglandin production, which in turn affects renal blood flow (Mazaleuskaya et al., 2015b). In pediatric care, the range of available medications is limited, particularly for home use, due to regulatory approvals. As a result, parents often turn to over-the-counter

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options, such as paracetamol and NSAIDs, to manage their children's pain and reduce fever. However, many parents may administer these medications without a full understanding of the potentially harmful side effects (de Bont et al., 2020; Jensen et al., 2010).

Studies conducted across different countries have consistently highlighted a concerning lack of awareness and knowledge regarding paracetamol, indicating a need for enhanced education and awareness campaigns to mitigate the risks associated with its toxicity (Boudjemai et al., 2013; Daifallah et al., 2021). Similarly, on a national scale, numerous studies assessing public knowledge of OTC medications, including various analgesics, have drawn parallel conclusions, emphasizing an insufficient level of understanding among individuals (Kamel et al., 2021; Murad et al., 2023). Particularly, as Kamel et al. (2021) mentioned a 97% of the Jeddah population demonstrated inadequate knowledge about antipyretic administration, indicating the value of investigating other Saudi Arabian locals (Murad et al., 2023). To the best of our knowledge, no studies have been conducted within the Al-Baha population to gauge their understanding of OTC ibuprofen and paracetamol medication, particularly regarding pediatric usage. Consequently, our focus was to bridge this gap by assessing the knowledge level of parents concerning the administration of OTC medications for their children.

2. Methodology

The study was an observational cross-sectional study conducted from January 2024 to August 2024. Approval was obtained on January 24, 2024, from the Scientific Research & Ethics Committee at the Faculty of Medicine, Al Baha University, Kingdom of Saudi Arabia. A self-administered questionnaire has been generated in Google Forms. It utilized a modified validated survey from a similar study conducted in Jeddah City (Kamel et al., 2021). The validation was achieved by launching a successful pilot study. The link to the questionnaire was disseminated to the target population through various social media applications, in-person interviews, and phone calls. The study population included Saudi and non-Saudi residents of the Al-Baha region who are 18 years of age and older. Inclusion criteria encompassed all Saudi and non-Saudi individuals residing in the Al-Baha region, both men and women, who had parented at least one child and agreed to participate in the study. Exclusion criteria included individuals aged 17 years and younger, non-Arabic or non-English speakers, those who refused to participate, or were unable to participate. The questionnaire covered parents' demographic information, their understanding of ibuprofen and paracetamol usage, their perspectives on these medications, and their habits related to these drugs, available in both Arabic and English.

Data analyses were performed using the Statistical Package for Social Sciences (SPSS) version 25. Frequency and percentages were used for the descriptive analysis. For the knowledge and practice questions, each correct answer was given 1 point, and each wrong answer was given 0. The cutoff point of the knowledge score was set at 7 out of 13. Participants with scores below 7 were considered to have a bad knowledge level, whereas those with scores equal to or above 7 were considered to have a good knowledge level. The cutoff point of the practice level was set at 6 out of 10; participants with scores below 6 were considered to have a bad practice level, whereas those with scores equal to or above 6 were considered to have a good practice level. Pearson's chi-squared test was used to analyze the degree of association between sociodemographic data and the knowledge and practice levels. $P < .05$ was considered statistically significant.

3. Results

The study included a total of 791 participants. Most participants were aged between 40-59 years (48.4%). A higher proportion of participants were females (63.2%). Significant associations were found with gender (p=0.03), wherein females scored a higher knowledge level compared to males. Almost all participants were Saudi nationals (99.4%). Most participants had a university education (74.7%). There is a significant association between the participants who have had a higher education and a higher practice score (p=0.03). Most of the participants were employed (58.2%). Most participants had more than three children (42.9%). The sociodemographic characteristics are summarized in Table 1. The overall level of knowledge, with a score more than 7, was good (68.9%); however, the overall level of the practice was negative, with 88.6% with a score level less than 6. These results are given in Table 2.

The studied medications were reported to be used for fever by 81.5% of participants and for pain by 68.8%. A total of 88.6% of participants indicated that they measure the child's temperature before administering the medication. More than half of the participants (53%) reported giving an antipyretic when the child's temperature was between 38°C and 38.5°C. Regarding symptoms of possible acute poisoning due to overdose, 50.2% of participants identified nausea and vomiting as likely symptoms, while 36.6% mentioned abdominal pain. Reported side effects included kidney injury, cited by 49.4% of participants for paracetamol and 54.7% for ibuprofen. When asked about factors influencing dosage, 53% of participants stated that they consider the child's weight. Most participants (85.3%) believed it was inappropriate to give ibuprofen to a child without consulting a doctor, whereas 66.5% held the same opinion about paracetamol. Additionally, 70.4% of participants considered it incorrect to administer paracetamol and ibuprofen together. Details of participants' knowledge regarding the use of paracetamol and ibuprofen are presented in Table 3.

Table 1: Sociodemographic characteristics and Association with knowledge and attitude

Sociodemographic	Total number N (%)	Knowledge level		P-value	Practice level		P-value
		Good	Bad		Good	Bad	
Age							
18-29	187 (23.6)	131 (70.1)	56 (29.9)		18 (9.6)	169 (90.4)	
30-39	206 (26)	134 (65)	72 (35)		26 (12.6)	180 (87.4)	0.8
40-59	382 (48.4)	270 (70.7)	112 (29.3)	0.5	44 (11.5)	338 (88.5)	
60 or more	16 (2)	10 (62.5)	6 (37.5)		2 (12.5)	14 (87.5)	
Gender							
Male	291 (36.8)	187 (64.3)	104 (35.7)		19 (6.5)	272 (93.5)	
Female	500 (63.2)	358 (71.6)	142 (28.4)	0.03*	71 (14.2)	429 (85.8)	0.001*
Nationality							
Saudi	786 (99.4)	542 (69)	244 (31)		90 (11.5)	696 (88.5)	
Non-Saudi	5 (0.6)	3 (60)	2 (40)	0.6	0	5 (100)	0.4
Education level							
No education	5 (0.6)	2 (40)	3 (60)		1 (20)	4 (80)	
Secondary	131 (16.6)	83 (63.4)	48 (36.6)		7 (5.3)	124 (94.7)	
University	591 (74.7)	413 (69.9)	178 (30.1)	0.2	78 (13.2)	513 (86.8)	0.03
Postgraduate	64 (8.1)	47 (73.4)	17 (26.6)		4 (6.3)	60 (93.8)	
Employment status							
Student	83 (10.5)	63 (75.9)	20 (24.1)		13 (15.7)	70 (84.3)	
Unemployed	191 (24.1)	130 (68.1)	61 (31.9)		23 (12)	168 (88)	
Retired	57 (7.2)	36 (63.2)	21 (36.8)	0.4	9 (15.8)	48 (84.2)	0.3
Employed	460 (58.2)	316 (68.7)	144 (31.3)		45 (9.8)	415 (90.2)	
Number of children							
0	192 (24.3)	128 (66.7)	64 (33.3)		20 (10.4)	172 (89.6)	
1	77 (9.7)	55 (71.4)	22 (28.6)		4 (5.2)	73 (94.8)	
2	76 (9.6)	53 (69.7)	23 (30.3)	0.9	5 (6.6)	71 (93.4)	0.05
3	107 (13.5)	74 (69.2)	33 (30.8)		19 (17.8)	88 (82.2)	
More than 3	339 (42.9)	235 (68.9)	104 (30.7)		42 (12.4)	297 (87.6)	

*: Statistically significant

Regarding practices of participants in administering paracetamol and ibuprofen, the antipyretic most given to children was paracetamol (74.3%), followed by both paracetamol and ibuprofen (13.6%). Regarding the recommended dose for paracetamol, only 15.4% of the participants identified the dose as 10-15 mg/kg. However, for ibuprofen, 37.7% of the participants identified the recommended dose as 4-10 mg/kg. Most participants (79.1%) reported reading the leaflet provided with the medication. In case of an overdose, 44.8% of parents would call an ambulance or consult a doctor immediately, while 24% would wait and monitor the child. These results are given in Table 4. Regarding sources of drug information, doctors were the most common source of information (74.3%), followed by pharmacists (63.1%). These results are shown in Fig. 1.

Table 2: The overall level of knowledge and practice

	Good level		Bad level	
	N	%	N	%
Knowledge	545	86.9	246	31.1
Practice	90	11.4	701	88.6

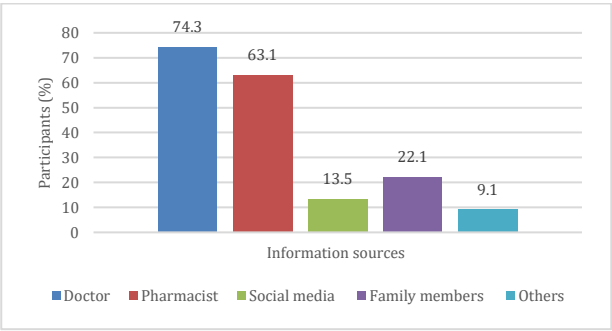

Fig. 1: Information sources

4. Discussion

This study, conducted in Al-Baha, Saudi Arabia, revealed a significant gap between knowledge and practices among parents in managing pediatric fever with over-the-counter (OTC) medications like paracetamol and ibuprofen. Although 68.9% of participants demonstrated good knowledge, 88.6% had poor practice levels. The findings align with other Saudi studies, such as those in Jeddah (Kamel et al., 2021), the western region of Saudi Arabia (Murad et al., 2023), and among a rural population in Bisha, where parents commonly used paracetamol but lacked sufficient awareness about ibuprofen, and the potential side effects of NSAIDs, that can pose gastrointestinal risks to children if misused (11–13). Additionally, a similar "fever phobia" was observed among parents in Lebanon (Sakr et al., 2022), Denmark (Dedeepya et al., 2021), Indonesia (Sinuraya et al., 2023), and Palestine (Daifallah et al., 2021), where anxiety about fever complications often leads to overtreatment, particularly when parents associate fever with severe outcomes like seizures or brain damage. This fear-driven response was similarly observed in Al-Baha, where parents displayed caution but often lacked adequate knowledge of safe practices.

International comparisons further highlight universal challenges. In Southeastern Poland and Serbia, although parents showed high health literacy, gaps remained in correctly applying weight-based dosing (Doria et al., 2021; Marano et al., 2023), a challenge also present in Al-Baha, where only 15.4% of parents could identify the correct paracetamol dose. Italian studies underscore the need for

standardized dosing guidelines, with experts recommending clear instructions for paracetamol and ibuprofen, emphasizing the potential for side effects like gastrointestinal issues when NSAIDs are misused (Doria et al., 2021; Marano et al., 2023). In this respect, these studies are consistent with the findings of other investigations (Hussain et al., 2020; Sakr et al., 2022). Similarly, in Al-Baha, correct dosing knowledge was limited, indicating the need for clearer guidance. Studies in Germany highlight the effectiveness of digital tools for parental education, showing that such resources could help address dosing inaccuracies and fever anxiety by providing accessible, evidence-based information, a solution that could be tailored for Saudi parents as well (Hussain et al., 2020).

Table 3: Knowledge of parents regarding paracetamol and ibuprofen

Question	Response	N (%)
Q1: I have enough information about using Paracetamol and Ibuprofen medications	- Agree	437 (55.3)
	- Neutral (Not sure)	322 (40.7)
	- Disagree	32 (4)
Q2: What are the reasons for giving Paracetamol and Ibuprofen? (You can select more than one option)	- Fever	645 (81.5)
	- Pain	544 (68.8)
	- Inflammation	239 (30.2)
	- Other	25 (3.2)
Q3: Do you measure the child's temperature before giving an antipyretic?	-Yes	701 (88.6)
	-No	90 (11.4)
Q4: How do you measure a child's temperature? (You can select more than one option)	- Using a thermometer	619 (78.3)
	- By touching the forehead	431 (54.5)
	- By touching the lips	40 (5.1)
Q5: At which temperature do you give antipyretic	38-38.5	419 (53)
	38.5-39	263 (33.2)
	>39	109 (13.8)
Q6: What are the symptoms of acute poisoning if a child takes an overdose of Paracetamol or Ibuprofen? (You can select more than one option)	- Abdominal pain	290 (36.6)
	- Nausea and vomiting	397 (50.2)
	- Severe diarrhea	203 (25.7)
	- Jaundice (yellowing of the skin and eyes)	128 (16.2)
	- Dizziness and severe drowsiness	158 (20)
	- I don't know	303 (42.1)
Q7: What are the side effects of Paracetamol? (You can select more than one option)	- Liver damage	306 (38.7)
	- Kidney damage	391 (49.4)
	- Effect on stomach	198 (25)
	- Allergy	101 (12.8)
Q8: What are the side effects of Ibuprofen? (You can select more than one option)	- Liver damage	305 (38.6)
	- Kidney damage	433 (54.7)
	- Effect on stomach	241 (30.5)
	- Allergy	130 (16.4)
Q9: What factors influence the choice of dosage for Paracetamol and Ibuprofen? (You can select more than one option)	- Child's weight	420 (53.0)
	- Child's age	511 (64.6)
	- Illness severity (degree of temperature)	323 (40.8)
Q10: What form of Paracetamol and Ibuprofen do you use? (You can select more than one option)	- Syrup	630 (79.4)
	- Suppositories	266 (33.6)
	- Injection	66 (8.3)
	- Syrup and suppositories together	155 (19.6)
Q11: Do you think it is correct to give Ibuprofen to a child without consulting a doctor?	- Yes	116 (14.7)
	- No	675 (85.3)
Q12: Do you think it is correct to give Paracetamol to a child without consulting a doctor?	- Yes	265 (33.5)
	- No	526 (66.5)
Q13: Do you think it is correct to give Paracetamol and Ibuprofen together?	- Yes	76 (9.6)
	- No	715 (70.4)

The present study finds that participants exhibited good knowledge, but poor practice is a recurring theme in research on medication administration by caregivers. This highlights the gap between theoretical understanding and real-world application. Factors contributing to this discrepancy and leading to deviations from recommended practices may include anxiety and stress when a child is ill, cultural beliefs and traditional practices that may conflict with evidence-based guidelines, and misinterpretation of dosage instructions or lack of confidence in dosage calculations. This is supported by research such as the study done in Jeddah, which determined that most caregivers had inadequate knowledge regarding factors that influence paracetamol and ibuprofen dosage and frequency of administration, increasing the risk of improper drug intake (Kamel et al., 2021). To avoid serious side effects, the study indicated the need for the development of educational route programs to provide parents with appropriate education and information on fever management (Kamel et al., 2021). The finding that a significant portion of participants struggled with accurate dosing of paracetamol and ibuprofen is particularly concerning. Incorrect dosing can lead to serious

adverse effects, including organ damage. The reported concerns about kidney injury as a side effect reflect a general awareness of potential risks but may also indicate a need for more precise information on the specific risks associated with each medication. Research done in Jordan indicates that parents often misuse antipyretic medications and have poor knowledge of basic information regarding fever (Athamneh et al., 2014). The reliance on doctors and pharmacists as primary sources of drug information underscores the importance of healthcare professionals in educating caregivers. However, the finding that misinformation and poor practices persist suggests that the current educational efforts may be insufficient. This highlights the need for clear and consistent communication from healthcare providers; accessible and reliable written materials, such as medication leaflets and online resources; and community-based education programs to address cultural beliefs and misconceptions. The common practice of administering antipyretics at relatively low fever temperatures (38-38.5°C) may reflect misconceptions about the benefits and risks of fever. It's important to educate caregivers that fever is a natural response to infection and that antipyretics should be used judiciously, rather than to suppress every temperature elevation. Studies have shown that there are many misconceptions about fever and its management (Hussain et al., 2020). It is very important that future studies focus on creating effective educational interventions that can improve parental practices regarding children's medication administration. Connecting the study's findings to policy implications, healthcare practices, and educational interventions, the significant gap between parental knowledge and actual practice highlights a systemic issue beyond individual caregiver shortcomings. Studies from countries with robust pharmacy-based counseling services (e.g., some European nations) demonstrate improved medication adherence and reduced adverse events (Higgins Joyce et al., 2023).

Table 4: Practice of parents regarding paracetamol and ibuprofen

Question	Response	N (%)
Q1: Most common antipyretic you give to your child?	- Paracetamol	588 (74.3)
	- Ibuprofen	95 (12)
	- Both	108 (13.6)
Q2: What is the recommended dose for paracetamol?	- Less than 10-15 mg/kg/dose	416 (52.5)
	- 10-15 mg/kg/dose	121 (15.4)
	- More than 10-15 mg/kg/dose	12 (1.5)
	- Not sure	5 (0.6)
	- I don't know	237 (30)
Q3: How often do you give paracetamol?	- Every 4 hr	146 (18.4)
	- Every 6 hr	314 (39.7)
	- Every 8 hr	283 (35.8)
	- I don't know	48 (6.1)
Q4: What is the maximum daily frequency of paracetamol?	- 2	136 (17.2)
	- 3	303 (38.3)
	- 4	231 (29.1)
	- 5	21 (2.7)
	- 6	41 (5.2)
	- I don't know	59 (7.5)
Q5: What is the recommended dosage for Ibuprofen?	- Less than 4-10 mg per kg	298 (37.7)
	- 4-10 mg per kg	122 (15.4)
	- More than 4-10 mg per kg	18 (2.3)
	- I don't know	343 (43.4)
	- Not sure	10 (1.3)
Q6: How often is Ibuprofen given?	- Every 4 hours	76 (9.6)
	- Every 6 hours	144 (18.2)
	- Every 8 hours	372 (47)
	- I don't know	199 (25.2)
Q7: What is the maximum daily frequency for giving Ibuprofen?	- 2 times	185 (23.4)
	- 3 times	243 (30.7)
	- 4 times	109 (13.8)
	- 5 times	15 (1.9)
	- 6 times	11 (1.4)
	- I don't know	228 (28.8)
Q8: Do you make sure to read the leaflet provided with the medication?	- Yes	626(79.1)
	- No	165(20.9)
Q9: What do you use as a measuring device when you give paracetamol/ ibuprofen?	- Teaspoon	117 (14.8)
	- Measuring spoon	477 (60.3)
	- Measuring syringe	706 (89.3)
Q10: What do you do if your child takes an overdose of Paracetamol or Ibuprofen?	- Give them a large amount of milk immediately to reduce the poisoning	141 (17.8)
	- Try to induce vomiting quickly	88 (11.1)
	- Call an ambulance/doctor immediately	355 (44.8)
	- Wait and monitor the child for any symptoms	190 (24)

Implementing mandatory counseling for OTC pediatric medications could bridge the knowledge-practice gap (Higgins Joyce et al., 2023). National campaigns, like those addressing vaccination hesitancy, are needed to address misconceptions and promote safe OTC medication practices. These campaigns should be culturally sensitive and leverage various media channels (Sinuraya et al., 2024). The low percentage of parents correctly identifying appropriate dosages suggests a need for clearer, standardized dosing guidelines, possibly incorporated into medication packaging and healthcare applications (D'Errico et al., 2022). Reliance on doctors and pharmacists as primary information sources underscores the importance of healthcare professional training. Incorporation of comprehensive OTC medication education into medical and pharmacy school curricula and continuing education programs, and the development of concise, evidence-based tools (e.g., dosing algorithms, visual aids) for healthcare professionals to use during patient consultations are recommended (Hoonakker et al., 2023). The present findings also foster collaboration between physicians and pharmacists to ensure consistent messaging and to address patient concerns; together with the use of simulation exercises to train parents on accurate medication administration and temperature measurement; and the leverage parent support groups and community networks to disseminate information and address cultural beliefs (Topping, 2022). They also urge the development of programs to enhance parents' ability to critically evaluate online health information and utilize digital health tools (Merga, 2024). The prevalence of misconceptions about fever and medication side effects highlights the need for culturally tailored interventions. Indicated interventions include conduction of qualitative studies to understand specific cultural beliefs and misconceptions related to fever and medication use, development of educational materials and messages that address these beliefs and misconceptions in a respectful and culturally sensitive manner, and engagement of community leaders and religious figures to promote accurate information and addressing cultural barriers (Leulseged et al., 2024). The potential of digital resources (applications, telemedicine) for improving parental education indicates the integration of digital health tools into the national healthcare strategy, ensuring equitable access and addressing digital literacy gaps, the establishment of clear guidelines and regulations for the development and use of health-related applications and online resources, and the promotion of interoperability between digital health platforms and electronic health records to facilitate seamless information sharing (Fitzpatrick, 2023).

5. Conclusions and recommendations

In view of the foregoing, community education would be the cornerstone of our recommendations. It is recommended to create targeted, easy-to-understand brochures in Arabic with visual aids, focusing on OTC medications, including clear dosing charts. These should detail potential side effects and warning signs, and provide instructions on accurate temperature measurement and when to seek immediate medical help. It is recommended to produce short educational videos demonstrating proper medication administration techniques, explaining fever management, and when to use antipyretics. Videos should be disseminated through social media, hospital waiting areas, and clinic websites. These should incorporate culturally relevant examples and scenarios, utilizing religious leaders and other influential figures to promote safe medication practices. It is recommended to design online modules with quizzes and interactive scenarios to reinforce learning, including a section on common misconceptions about fever and OTC medications.

Modules should be accessible through healthcare applications and websites. It is recommended to organize workshops in community centers, schools, and mosques; to train healthcare professionals to lead these workshops, and to provide hands-on demonstrations of temperature measurement and medication administration. It is recommended to develop standardized counseling protocols for physicians and pharmacists to ensure they provide consistent and accurate information on OTC medication use; to include OTC medication education as a standard part of well-child visits; to include clear instructions on OTC medication use in hospital discharge packets; and to emphasize the importance of following dosage guidelines. It is recommended to train pharmacists to provide detailed counseling on OTC medication use and to create dedicated counseling areas in pharmacies. In the area of leveraging digital technology, it is urged to develop a dedicated mobile application that includes a dosage calculator, medication reminders, and symptom tracker; provide access to educational videos and articles; and include a feature to connect with healthcare professionals. It is also urged to offer telemedicine consultations for parents with questions about OTC medications and to provide virtual demonstrations of medication administration.

It is urged to facilitate online forums where parents can share experiences and ask questions, and to moderate these forums to ensure accurate information is provided. It is urged to send out reminder messages about medication schedules and to send messages that contain links to educational resources.

Finally, it is recommended to gather feedback from healthcare professionals and parents on the effectiveness of educational materials, to identify areas for improvement, to track adverse events related to OTC medication use in children, to use these data to refine educational strategies, and to update educational materials to reflect the latest evidence-based guidelines.

Compliance with ethical standards

Ethical considerations

This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. The ethical approval was obtained by the Ethics Review Board of Al-Baha University, Saudi Arabia (number: REC/SUR/BU-FM/2024/10). Informed consent was obtained from all participants, and their confidentiality was ensured.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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