Online Journal of Biological Sciences

Original Research Paper

The Use of Chatgpt by Pediatric Physicians in the Management of Childhood Asthma in the City of Marrakech (Morocco)

[1]Maryem Labyad, [2]Ghizlane Draiss, [2]Karima El Fakiri, [3,4]Nadia Ouzennou and [2]Mohamed Bouskraoui

[1]Infectious Disease Research Laboratory, Faculty of Medicine and Pharmacy, Cadi Ayyad University, Marrakech, Morocco
[2]Department of Pediatric, Faculty of Medicine and Pharmacy of Marrakech, University Hospital Mohamed VI, Cadi Ayyad University, Morocco
[3]Department of Biology, Faculty of Sciences Semlalia, Pharmacology, Neurobiology, Anthropobiology, and Environment Laboratory, Cadi Ayyad University, Marrakech, Morocco
[4]ISPITS, Higher Institute of Nursing and Technical Health, Marrakech, Morocco

Article history
Received: 16-06-2024
Revised: 04-09-2024
Accepted: 09-09-2024

Corresponding Author:
Meryem Labyad
Infectious Disease Research Laboratory, Faculty of Medicine and Pharmacy, Cadi Ayyad University, Marrakech, Morocco
Email: l.meryam84@gmail.com

Abstract: Pediatric asthma is a chronic disease requiring continuous management, where digital tools, such as ChatGPT, are beginning to play a vital role, in optimizing physicians' efficiency, reducing their workload, and improving communication with patients. However, its integration raises questions about the accuracy of the information provided and data security. In addition, the use of ChatGPT in clinical practice remains little explored compared to its use in the field of researsch. In this context, this study aims to describe the use of ChatGPT by pediatricians, assess its advantages and limitations, and suggest recommendations for optimal integration of this tool in the context of pediatric asthma. A prospective survey was conducted for one month at the mother-child hospital in Marrakech. Data were collected online using a structured questionnaire from all pediatric doctors working in this establishment. Data analysis was performed using descriptive methods in addition to bivariate and multivariate analyses, with SPSS software. The study included 53 pediatric physicians, represented mainly by women (94.3%). Approximately 56,6% of doctors used ChatGPT in the management of children with asthma, especially for abstracting (41.5%), translating (35.84%), and asking medical questions (22.64%). The main reasons for use were; simplification of administrative tasks (44.11%) and the rapid access to information (35.29%). Although 57% of physicians were satisfied with ChatGPT's use, limitations such as lack of customization (26.6%) and reliance on technology (31.3%) were noted. User doctors were the ones who were familiar with this technology and who encountered more difficulties in the management of pediatric asthma ($p<0.001$). Although recent, ChatGPT is already widely adopted by pediatricians for some specific tasks in the management of childhood asthma, such as writing summaries, translating, and answering questions, while leaving clinical decisions under the control of physicians. This highlights both the effectiveness of the tool and the need for strict human supervision and enhanced security measures.

Keywords: ChatGPT, Asthma, Child, Pediatrician, Artificial Intelligence, Chatbot

Introduction

Artificial Intelligence (AI) is a fast-growing field of research that aims to perform tasks that would normally require human intelligence (Radanliev *et al*., 2022). It is defined as a system that operates through a machine that, in response to a set of human-defined objectives, is capable of making predictions, recommendations, or decisions that influence real or virtual environments (OCDE, 2019) AI is applied in various fields, including medicine, where it is deployed in two distinct categories: The virtual dimension, exploiting neural networks to make therapeutic choices and manage electronic health records for example and the physical component, integrating technologies such as surgical robots, intelligent prostheses and care solutions for the elderly

(Hamet and Tremblay, 2017) in fact, these advances clearly show that the applications of AI in medicine are vast, ranging from identifying potential research subjects to assisting professionals with clinical and laboratory diagnostics (Kharat, 2022). Although it offers significant benefits by improving accuracy, precision, and efficiency. AI also raises major challenges, both medically, ethically, and socially (Carter *et al*., 2020)

Among AI systems; are Large Linguistic Models (LLM) which are specialized systems trained on a massive amount of textual data, they are designed to mimic human language processing capabilities, using deep learning techniques, such as neural networks to; generate a script, make a translation or summary and paraphrase a text (Singhal *et al*., 2023).

In addition to LLMs, chatbots are another notable application of AI. They are defined as; a computer program designed to simulate a conversation with human users, offering dynamic and intelligent interactions (Adamopoulou and Moussiades, 2020). It's important to note that there's a second type of chatbot that doesn't use AI; based on simple rules rather than machine learning algorithms, these chatbots follow pre-established scripts and provide pre-programmed responses based on the user's interactions. Thus, the integration of AI into chatbots represents a major advance in their operation, enabling them to understand and interpret natural language and provide contextual responses, thus playing a crucial role in improving the efficiency of the services provided by chatbots (Kharbouch, 2021).

Among these is the Generative Pretrained Transformer (ChatGPT), created in November 2022 by OpenAI. Since then, the number of users has grown steadily, setting a record for rapid growth among consumer applications (Eysenbach, 2023).

During the study period, the most recent versions of GPT were GPT-3.5 and the paid version, GPT-4.0, which were unveiled in March 2022 and March 2023 respectively. The comparative study between these two versions showed that GPT-4.0 marked a significant advance over GPT-3.5 in the evaluations for the American Board of Ophthalmology examination (Taloni *et al*., 2023). In the same vein; in January 2022; a survey using the GPT-3 version showed its ability to pass the US medical license exam and in January 2023 GPT-3.5 achieved scores of 66% and 72% respectively in the Basic Life Support and Advanced Cardiovascular Life Support tests (Fijačko *et al*., 2023).

The ability of ChatGPT to enrich clinical practice is well documented (Pedersen *et al*., 2020) , including optimizing physician efficiency and reducing the workload associated with patient care (Eysenbach, 2023). This efficacy is particularly relevant when considering pediatric asthma, a complex condition requiring rigorous supervision and constant communication between healthcare professionals and families.

This chronic respiratory disease affects more than 300 million people and causes 250,000 deaths in the Eastern Mediterranean region (*WHO EMRO | Asthme | Thèmes de santé*, s. d.)its prevalence is increasing significantly, especially in developing countries (De Almeida *et al*., 2001). In Morocco, the AIRMAG study conducted in 2008 showed that the prevalence of asthma was around 3.7% in adults and 4.4% in children (Natfi *et al*., 2009).

In this context of high and increasing prevalence, effective management of pediatric asthma becomes essential to mitigate the negative impacts of the disease. Indeed, insufficient asthma control can significantly impair the quality of life of children and their parents, leading to school absences and increasing the demand for time and effort on the part of caregivers (BinSaeed *et al*., 2014).

Faced with these challenges, the integration of ChatGPT could play a key role in the management of this disease, especially with the rapid adoption of this technology by patients and practitioners (Nadarzynski *et al*., 2019). In this regard, a recent study demonstrated that AI can quickly and accurately identify asthma in children, helping pediatricians make a more reliable diagnosis, This will enhance asthma management, optimize healthcare utilization, and reduce the overuse of antibiotics and systemic corticosteroids (Yu *et al*., 2020) In the same sense, ChatGPT can complement traditional care, providing ongoing support for asthma patients, particularly in the assessment of attack triggers and monitoring of treatment, which also improves disease control (Darren *et al*., 2024).

Indeed, ChatGPT has proven to be a satisfactory source of information in the context of asthma diseases (Dalal *et al*., 2024). However, despite this finding, practitioners should be wary of the responses generated by ChatGPT as they may sometimes lack completeness and lead to confusion and errors (Benichou, 2023) as ChatGPT cannot completely replace the doctor-patient relationship (Darren *et al*., 2024)

This dichotomy between the potential benefits and limitations of ChatGPT strongly motivated our study. In addition, the insufficiency of studies relating to the direct application of ChatGPT in the management of patients (Xue *et al*., 2023) , in comparison with its more widespread use in medical research (Biswas, 2023) highlights the importance of our approach. Thus, this study aimed to describe the current use of this tool by pediatricians in the city of Marrakech in Morocco, to better understand its advantages and limitations and to formulate recommendations for optimal application in the management of pediatric asthma.

Materials and Methods

Data Collection

In the present study, data collection was carried out online (Google forms), using a structured, self-administered questionnaire containing 24 questions; (18 closed multiple-choice questions and 6 open questions). It was clarified at the beginning of the questionnaire how respondents should interact with each type of question.

A preliminary version of the questionnaire was tested on a small sample of pediatricians to ensure the clarity and relevance of the questions. Feedback from this pilot phase allowed the questions to be refined and any ambiguities corrected before official distribution.

Study Location and Duration

This was a prospective cross-sectional survey conducted over one month (06-05-2023 and 02-06-2023). The study site was the pediatrics department at the Hôpital Mère-Enfant (HME), part of the CHU Mohamed VI in Marrakech. This hospital cares for asthmatic children up to the age of 15, from all over the Marrakech region, through the hospitalization service, pediatric emergencies, and follow-up of these children at the level of the pneumo-pediatric consultation and the day hospital.

The Target Population

The study population consisted of pediatric physicians assigned to the MCH who agreed to participate in the study. These physicians are responsible for the care of asthmatic children requiring referral to the university hospital center, either through on-call duty in the hospitalization ward or in the pediatric emergency department. They also monitor these children at the pediatric consultation and day hospital.

We opted for a census in our survey of pediatric physicians to ensure maximum representativeness and reduce sampling bias.

Survey Progress

Prior to the launch of the survey, an updated list of practicing pediatricians was established. This step was essential to ensure that the questionnaire was distributed comprehensively to all pediatricians involved in the care of children with asthma. The questionnaire was then distributed electronically via Google Forms to the identified pediatricians and the questionnaire responses were automatically collected and stored in a secure database.

Study Variables

Personal and professional details of pediatricians: Age, gender, grade, seniority, difficulties encountered in managing asthmatic children.

The use of ChatGPT by pediatricians in the management of childhood asthma: Duration of use, reasons for use, place of use, elements of management insisting on the use of ChatGPT, advantages, and limitations of the use of ChatGPT, physicians' perception of the use of ChatGPT in the management of childhood asthma, physicians' recommendations for the effective use of ChatGPT.

Statistical Analysis

Data analysis was performed using the Statistical Programme for Social Sciences (SPSS) software, version 22 for Windows. The data were first subjected to univariate analysis to describe and summarize the main characteristics of the study population; continuous variables were described by the mean and standard deviation and categorical variables by absolute and relative frequencies. This step allowed us to identify general trends and to better understand the distribution of the variables.

To identify factors associated with the use of ChatGPT in the management of pediatric asthma, a bivariate analysis was performed. Students' correlation coefficient was adopted to study the correlation between the use of ChatGPT and quantitative variables and to research the correlation with qualitative variables, the Chi 2 test was used. A statistical significance threshold of $p<0.05$ was adopted to determine significant associations.

The variables found to be statistically significant in the bivariate analysis were then included in a multivariate logistic regression model. This multivariate analysis allowed the strength of the associations to be assessed using Odds Ratios (OR), with a 95% Confidence Interval (CI). This made it possible to determine the independent predictors of ChatGPT use, taking into account potential interactions between variables.

Results

Personal and Professional Data of Pediatricians

The population included in the present study was made up of 53 pediatricians (with a response rate of 78%); more than half (52.8%) were in the 30-40 age bracket (the average was 28 years), with a predominance of women (94.3%). The respondents were all residents of general pediatrics, who did not have a specialty in pneumology or allergology. The majority (68%) of these physicians have been in practice for more than three years and reported examining an average of 3 asthmatic children per day. In addition, the results of the study also indicated that 69.8% of doctors reported having encountered difficulties in managing childhood asthma in their professional practice. Indeed, 26.5% reported problems with therapeutic management, 24% mentioned difficulties in assessing asthma control in their patients and 20.5% reported obstacles in identifying the degree of asthma severity.

Pediatricians' Use of ChatGPT

Our results showed that 77.4% of pediatricians were aware of ChatGPT and 56,6% of cases used this technology, mainly during regular consultations for asthmatic children (86,6%). The average duration of use of ChatGPT was 1-2 months for 53.3% of user physicians. In response to a query about the main uses of ChatGPT, pediatricians stated that they use it for creating clinical summaries (41.50%), translating (35.84%), and obtaining medical information (22.64%). Not a single doctor made a medical decision using technologyreasons for using Chatgpt by pediatric physicians.

According to the pediatricians surveyed, the main factors influencing this use were the simplification of administrative tasks (44.11%), rapid access to information (35.29%), and the complexity of the situation (20.6%).

Perceived Benefits and Limitations of ChatGPT Use by Pediatric Physicians

In terms of overall satisfaction, 50% of pediatricians using ChatGPT expressed a high degree of satisfaction with the use of this technology in the management of childhood asthma. In addition, half of the pediatricians surveyed perceived an improvement in patient satisfaction when using ChatGPT and 45.5% of respondents noted a reduction in working time. However, the limitations most frequently reported by physicians were lack of interface customization (26.6%) and dependence on technology (31.3%).

Pediatricians Recommendations for Using ChatGPT

The recommendations for the use of ChatGPT most suggested by pediatricians were to use this technology as an additional reference tool (business tool) rather than a stand-alone tool (31%) and they recommended putting in place the necessary measures to ensure the confidentiality and security of their data shared with ChatGPT (29%), in addition to educating patients and their families about the use of ChatGPT (16.7%) (Table 1).

Correlation of ChatGPT Use with Study Variables

Our results showed that most pediatricians who were aware of ChatGPT, used it, ($p<0.001$, OR = 27.73; 95% CI [5.77-133.28]) and that these users were those who encountered the most difficulties related to the management of pediatric asthma ($p<0.00$, OR = 68; 95% CI [7.40-624.18]).

Table 1: Personal and professional characteristics of pediatric physicians and their use of ChatGPT at the MCH, CHU Marrakech (N = 53)

Variables	Number	%
Age		
<under 30	18	34,0
Between 30 and 40	28	52,8
>over 40	7	13,2
Gender		
Female	50	94,3
Male	3	5,7
Seniority		
Less than three years	17	32,0
More than three years	36	68,0
Average number of children examined per day		
< to 2 children	6	11,3
Between 2 and 4 children	38	71,7
>4 children	9	17,0
Difficulties in managing asthmatic children		
Yes	37	69,8
No	16	30,2
Difficulties encountered in managing asthmatic children		
Diagnosis of childhood asthma	2	2,0
Asthma treatment	32	26,5
Identifying asthma severity	25	20,5
Assessment of asthma control	29	24,0
Determination of poor control factors	17	14,0
Determining the time for an appointment	16	13,0
Knowledge of ChatGPT		
Yes	41	77,4
No	12	22,6

Table 1: Continue

Use of ChatGPT in the management of asthmatic children		
Yes	30	56,6
No	23	43
Duration of using the ChatGPT		
Less than one month	14	26,4
Between 1 and 2 months	16	30,2
Place of using the ChatGPT		
Normal consultation	26	49,1
Urgent consultation	4	7,5
Frequency of use of ChatGPT in daily practice		
Several times a week	10	18,9
Sometimes, as needed	20	37,7
ChatGPT use cases by pediatricians		
Creating summaries	22	41,50
Translations	19	35,84
Asking medical questions	12	22,64
Making medical decisions	0	0
Reasons why pediatricians use ChatGPT		
Simplification of administrative tasks	15	44,11
Quick access to information	12	35,29
The complexity of the situation	7	20,6
Physicians' assessment of the use of ChatGPT in the management of childhood asthma		
Very satisfactory		
Not very satisfactory	15	50
Not at all satisfactory	13	43,33
	2	6,66
The benefits of using ChatGPT in the management of childhood asthma according to pediatric physicians		
Improved quality of care	3	4,5
Reduced working hours	30	45,5
Patient Satisfaction	33	50,0
The limits of using ChatGPT in the management of childhood asthma according to pediatric physicians		
Dependence on technology	20	31,3
Lack of personalization	17	26,6
Misinterpretation	13	20,3
Data insecurity	9	14,0
Interface complexity	5	7,8

Table 2: Correlation of the variables studied with the use of ChatGPT by pediatricians and multivariate analysis of factors influencing the use of ChatGPT

Variables	Using ChatGPT		*P*	*OR*	ICI (95%)	*P*
	Yes (n = 30)	No (n = 23)				
Age						
<under 30	12	6				
Between 30 and 40	14	14	0,538		NS	
>over 40	4	3				
Gender						
Female	29	21	0,402		NS	
Male	1	2				
Seniority						
Less than three years	12	5	0,158		NS	
More than three years	18	18				
Average number of children examined per day						
< to 2 children	6	9			NS	
Between 2 and 4 children	21	10	0,150			
> 4 children	3	4				

Table 2: Continue

Difficulties in managing asthmatic children			<0,001	27,73	[5,77-133,28]	<0,001
Yes	29	8				
No	1	15				
Knowledge of ChatGPT						<0,001
Yes	30	11	<0,001			
No	0	12		1 68	[7,40-624,18]	

No association was found between ChatGPT use and age, gender, seniority, location of ChatGPT use, or average number of asthmatic children seen per day. (Table 2).

NS: Not Significant, a p-value <0.05 is considered significant. OR: Odds Ratio calculated by logistic regression. CI. Confidence Interval.

Discussion

Over the past few years, the development and implementation of ChatGPT in medical practice has attracted growing interest, with more than 100 million users in the first two months (Holderried *et al*., 2024), which explains its extensive use by pediatricians in our study, who have shown an interest and curiosity in using ChatGPT in their daily practice, after learning about its applications in the medical field, especially with its free and open access on the MCH network. Additionally, accessibility via personal devices or the institution's network plays an important role in this use, making the tool easily available.

However, it is essential to ensure that this mass adoption is accompanied by adequate training and rigorous evaluation (Liu *et al*., 2023). This will maximize the benefits while minimizing the potential risks inherent in the use of this technology in the sensitive context of children's asthma.

Indeed, this immediate availability of the tool facilitates its use for practical tasks such as developing summaries, translating documents, and finding answers to medical questions, as reported by pediatricians. This shows the usefulness of this technology in the field of pediatric asthma.

Creating summaries saves time by rapidly simplifying complex information, which is particularly valuable for preparing consultations and writing reports (Eysenbach, 2023). In addition, the translation of documents improves communication with non-French-speaking patients and colleagues, facilitating a more fluid exchange of medical information. Also, the answer to medical questions which is a frequent use of ChatGPT (Liu *et al*., 2023) can support healthcare professionals in various activities including triage and disease screening, while contributing to training and education (Milne-Ives *et al*., 2020). However, it is important to emphasize that these responses may vary depending on the time and the questions asked and that there is a risk of harmful bias in the responses provided (Grünebaum *et al*., 2023; Clusmann *et al*., 2023) Although pediatricians have reported all of these uses in the field of pediatric asthma, it is important that the future development of this technology in medicine should focus on augmenting human expertise rather than replacing it, ensuring that healthcare professionals retain a central role in patient care (Karabacak and Margetis, 2023).

Our results showed that this use was generally observed over a period of less than two months, given that this is a relatively recent technology in the medical field (Biswas, 2023), so doctors need to familiarize themselves with its interface and functionalities, which can be time-consuming.

Actually, in the management of pediatric asthma, the initial use of ChatGPT seems to mark an experimental phase where physicians test its effectiveness. This period will allow us to see how the tool can be systematically integrated into their practice to improve the care of asthmatic children. Moreover, this use was mainly during the asthmatic child's regular consultations, without being involved in urgent medical situations where medical decisions require immediate and direct clinical assessment by practitioners. In fact, regular consultations play an important role, mainly during the child's regular asthma consultations, given the importance of these consultations in monitoring symptoms, asthma control, education, and therapeutic adaptation (Lougheed *et al*., 2012). This indicates that AI can be an essential resource to help practitioners overcome the challenges of disease management (Horvat *et al*., 2022; Rao *et al*., 2023). These difficulties were confirmed by the results of a study in which 53% of doctors agreed that they had encountered obstacles relating to background treatment (60.5%) and the complexity ofthe Global Initiative for Asthma (GINA) recommendations (49.8%) (Ben Ameur *et al*., 2022). Similarly, the pediatricians in our study expressed obstacles when caring for asthmatic children, thus explaining the significant correlation found with the use of this technology.

Among the reasons for use frequently expressed by respondents was, on the one hand, the simplification of administrative tasks. By simplifying administrative processes, ChatGPT frees up valuable time for doctors, enabling them to devote more time to listening to patients'

concerns, carrying out in-depth examinations, and explaining treatments (Sallam, 2023) On the other hand, the second reason was to access information quickly, however, despite this justification for the use of ChatGPT, it is important to note that the effectiveness of management should not be linked to the notion of speed, but rather to the conformity of information with international recommendations. Indeed practitioners must remain vigilant with regard to the diagnoses and decisions proposed by ChatGPT, in order to avoid delays in management (Xue *et al*., 2023), especially when using the free version of ChatGPT, which does not access web data, leading to a potential lack of up-to-date data and the risk of hallucinations (Kedia *et al*., 2024). Hence the need for pediatricians to regularly check the compatibility of the data generated by ChatGPT, with the results of specialized tools, recent medical publications, and international guidelines such as those of GINA. The latter is of great importance, providing a clear and well-founded framework for guiding asthma management (Dubin *et al*., 2024).

In addition, ChatGPT is based on a Machine Learning system that trains the model on a considerable corpus of text data, to predict the next word in a sentence based on previous words, as a result, ChatGPT lacks the ability to understand the medical context and make decisions (Koubaa *et al*., 2023). In this sense, a study exploring doctors' perceptions of the use of Chatbots in the medical field revealed that 71% of them claimed that Chatbots couldn't decide on a diagnosis or treatment because they didn't know patients' specificities and associated factors (Palanica *et al*., 2019). Similarly, the doctor-patient relationship is an essential pillar of medicine and the doctor's role in building this relationship is irreplaceable by AI today. As a result, the final word in any medical decision must always rest with the doctor,especially in the case of childhood asthma, which requires rigorous monitoring and personalized adaptation of treatments, aspects for which direct clinical assessment and medical expertise are indispensable (Ducharme *et al*., 2015). So, the use of ChatGPT should be complementary, not substitutive, supporting physicians without replacing their clinical judgment.

Our results highlighted a range of benefits perceived by pediatric physicians after using ChatGPT, including patient satisfaction and reduced work time. By providing rapid responses, ChatGPT can minimize practitioners' time and workload, significantly reducing patient waiting times, so doctors have more time to focus on caring for their patients in a responsive and reassuring experience (Manohar *et al*., 2024). Indeed, ChatGPT's ability to simulate human interactions is a very important quality that makes the tool easier to use, and more adaptable, improving communication and fostering trust (You and Gui, 2021; Koubaa *et al*., 2023). So patients can also communicate with ChatGPT in a way that feels more natural and conversational (Halaseh *et al*., 2024). In this sense, a study analyzing the advantages and limitations of ChatGPT has shown that it can be considered as a virtual assistant to help patients monitor their health, providing information and advice leading to patient satisfaction (Dave *et al*., 2023). However, it is important to emphasize that results concerning patient satisfaction and workload reduction remain subjective and may vary from practitioner to practitioner. Formal satisfaction surveys and workload studies may be needed to confirm these observations more objectively.

Although ChatGPT can provide fast, relevant information, asthma management remains a complex field where understanding and therapeutic approaches are constantly evolving (Archibald *et al*., 2015). Indeed, a great deal of caution is required when using this new technology (Khan *et al*., 2023), in view of its potential limitations, notably the lack of personalization of the interface and over-reliance on technology, as raised by the pediatricians in our study. The perception of these limitations seems to be a legitimate concern when considering the integration of ChatGPT into a practice as delicate and specific as pediatric asthma. Interface personalization could include the ability to customize user settings or preferences, this can encompass several elements such as; styling, functionality, and other customization options, with the aim of improving the user experience by making the interface more tailored to their needs (Ojeda Meixueiro *et al*., 2024). In our context; features can be integrated into a customized ChatGPT interface for pediatric physicians, to meet the specific needs of this medical field. Examples of such features include: (1) A database of pediatric asthma medications, (2) A dose calculation tool based on the child's weight and age, and (3) Standardized treatment protocols for pediatric asthma.

At the same time, recent advances in GPTs announced by OpenAI offer promising solutions enabling users to create templates that provide more specific prompts, that are adapted to the requirements of medicine, which could improve the personalization of responses that take into account factors such as medical history, patient age and individual preferences (Holderried *et al*., 2024). With this in mind, OpenAI added a "custom instructions" option at the end of July, enabling you to fine-tune the chatbot's responses right from the start of each conversation (Ojeda Meixueiro *et al*., 2024) Indeed, ChatGPT users should never consider this technology as a substitute for human qualities (Ravindra *et al*., 2023; Jayakumar *et al*., 2021). Because Chatbots may also have difficulty identifying reliable sources and capturing important information (van Dis *et al*., 2023), which can lead to impersonal and inaccurate responses (Cahan and Treutlein, 2023). For these reasons, pediatricians need to be aware of the limitations of using this tool in an informed manner to ensure accurate results (Kitamura, 2023; Shen *et al*., 2023),

especially in the case of childhood asthma, to prevent complications caused by failure to maintain well-controlled asthma, including exacerbations, emergency room visits and hospitalizations (Mjid *et al*., 2017).

Regarding recommendations for the use of ChatGPT; pediatric physicians suggested using it as an additional reference tool rather than a stand-alone tool, This means that ChatGPT should be used as an additional resource to be consulted rather than relying on it alone (Dave *et al*., 2023). The same observation was endorsed by the results of a study that aimed to conduct experiments with ChatGPT, which showed that although this technology worked as a guide, it is not a miracle solution and its data needs to be supplemented or validated by other sources (Chatterjee and Dethlefs, 2023). Additionally, the use of ChatGPT as an additional reference tool should never replace the expertise acquired by physicians, who integrate elements of socio-cultural context and other important factors, which AI is still a long way from being able to integrate. Indeed ChatGPT is unable to handle the complexity of clinical work on its own (Fijačko *et al*., 2023), Hence the need to regularly assess the results obtained and adjust medical interventions accordingly, as suggested by the pediatricians who took part in this study.

Another recommendation suggested by pediatricians is their concern about data security when using ChatGPT, as in the case of patient interaction summaries and medical records (Dave *et al*., 2023). In a professional context, the role of users in data security is crucial, as the entry of sensitive patient or facility data may be accessible to others if they ask questions along the same lines, causing a potential data breach. Consequently, the implementation of security measures when using ChatGPT seems paramount, such as (1) Data encryption, preventing unauthorized access, (2) Access control, granting user authorizations according to roles, and (3) Regular security audits, with the aim of implementing any necessary security patches World Health Organization (WHO), 2017. In parallel, users can also strengthen the security of their ChatGPT accounts, by adopting a set of measures such as creating strong passwords, two-factor authentication (2F), monitoring login history, account settings, and any unusual behavior, and users should ensure that devices used to access ChatGPT accounts are protected by anti-virus software (KAM, 2023).

Regarding the regulatory framework for the use of ChatGPT, Morocco has set up a commission on the ethics of artificial intelligence (Adnani and Haounani, 2024). Indeed, a promising approach can be adopted in our context, by attributing AI systems an electronic personality and thus conferring them legal status, as in the case of Saudi Arabia, for example, which granted citizenship to the "Sophia" robot in 2017, conferring on it a status similar to that of human beings. This will guarantee effective protection for people while promoting innovation(Jaynes, 2021).

It is therefore becoming urgent for the medical community to anticipate technological developments and participate in the joint reflection on a framework governing the use of ChatGPT in the medical field. To do this, it will be able to rely on the AI law proposed by the European Union, in addition to the General Data Protection Regulation (GDPR) of 2018 and the ethical guidelines of 2019 (Mullins *et al*., 2021). Like these regulations, this new law could also become a global standard.

In another vein, ChatGPT can also play an important role in patient education (Ravindra *et al*., 2023) , for example, by providing a written treatment plan that stresses the importance of adhering to asthma medication and following inhaler technique guidelines (Lougheed *et al*., 2012). In this sense, the interviewed pediatricians suggested that parents of asthmatic children need to be informed about the benefits and limitations of using ChatGPT. This information would enable parents to better understand how to use this tool to obtain reliable information and to ask specific questions about their child's asthma management. Similarly, parents should be aware that ChatGPT is not a substitute for professional medical advice and treatment. For example, ChatGPT generates patient texts containing drug interactions, potential side effects, and contraindications (Bernard, 2023). However, these answers remain general, as he cannot offer prescriptions or dosage instructions. In this case, he indicates that he is not authorized to prescribe medication or give medical advice and encourages consultation with a healthcare professional. In fact, parents must always refer to the medical prescription, which is drawn up by the attending physician according to a personalized treatment plan, a task that ChatGPT is unable to perform..

Conclusion

In conclusion, our study highlighted a notable adoption of ChatGPT by pediatric physicians in the management of childhood asthma. Although its use is still recent, this tool has already shown satisfactory results for tasks such as summarization, translation, and answering medical questions. Its integration into regular and follow-up consultations highlights its potential to improve continuity of care and increase the efficiency of medical interventions, especially in difficult care contexts. Nevertheless, despite the considerable advantages it offers in terms of patient satisfaction and time savings, it is essential to recognize its limitations, including the lack of interface customization and increased reliance on technology. It remains essential to refer to medical expertise to ensure accuracy when using it in the management of childhood asthma.

To overcome these challenges, it is recommended to use ChatGPT as a complementary reference tool, while implementing enhanced security measures and providing tailored patient education for optimal use.

All these findings highlight the relevance of ChatGPT as a support in the management of pediatric asthma while emphasizing the need for a supervised approach to maximize its benefits and minimize potential risks.

Our study has some limitations, including the small sample of pediatric physicians, the use of self-reported perceptions susceptible to bias, and the lack of direct evaluation of ChatGPT's clinical impact on the health of asthmatic children. To investigate these findings further, future studies could expand the sample of participants, conduct controlled clinical trials to assess the actual impact of ChatGPT, compare its effectiveness with other medical decision support tools, conduct longitudinal studies to observe the long-term impact and analyze potential biases in ChatGPT responses. By integrating these proposals, future research will be able to provide a more comprehensive and nuanced understanding of the impact and implications of using ChatGPT in pediatrics and pediatric asthma management.

Acknowledgment

We would like to express our deep gratitude to the MCH pediatricians for their invaluable participation in this study. Their contribution has enabled us to collect important data and gain a better understanding of the integration of artificial intelligence technologies in the field of pediatric health. We would also like to thank the Hospital Director for her support and encouragement.

Funding Information

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

Author's Contributions

Maryem Labyad: Initial study designed, general coordination of the project, planning of the research methodology, development of data collection tools, data collection, analysis and interpretation of data, statistical analysis of data, and writing of the manuscript.

Ghizlane Draiss, Nadia Ouzennou and Mohamed Bouskraoui: Initial study designed, general coordination of the project, planning of the research methodology, development of data collection tools, supervision.

Karima El Fakiri: Analysis and interpretation of data and written of the manuscript.

Ethics

At the beginning of the questionnaire, the objectives of the study were clearly presented and it was specified that participation was completely free and voluntary. In fact, by answering the questionnaire, pediatricians implicitly gave their informed consent. The data collected were anonymized to ensure the confidentiality of the participants and only authorized persons had access to this data, in accordance with the standards in force for the protection of personal data in the context of research. In addition, the survey data will be destroyed immediately after the publication of the article.

The study protocol was approved by the local ethics committee and authorization for data collection was obtained from the university hospital management.

References

Adamopoulou, E., & Moussiades, L. (2020). An Overview of Chatbot Technology. *Artificial Intelligence Applications and Innovations*, *584*, 373. https://doi.org/10.1007/978-3-030-49186-4_31

Adnani, E., & Haounani, A. (2024). L'intelligence Artificielle au Maroc: Entre éthique et réglementation. *Revue Internationale de La Recherche Scientifique (Revue-IRS*, *2*(3), 1234–1252. https://doi.org/10.5281/zenodo.11621028

Archibald, M. M., Caine, V., Ali, S., Hartling, L., & Scott, S. D. (2015). What Is Left Unsaid: An Interpretive Description of the Information Needs of Parents of Children with Asthma. *Research in Nursing & Health*, *38*(1), 19–28. https://doi.org/10.1002/nur.21635

Ben Ameur, S., Elasmar, K., Jdidi, J., Belhadj, R., Aloulou, H., Maaloul, I., Damak, J., & Kammoun, T. H. (2022). General Practitioners' Management of Childhood Asthma in Sfax, Tunisia. *Revue Des Maladies Respiratoires*, *39*(10), 839–847. https://doi.org/10.1016/j.rmr.2022.09.006

Benichou, L. (2023). The Role of Using ChatGPT AI in Writing Medical Scientific Articles. *Journal of Stomatology, Oral and Maxillofacial Surgery*, *124*(5), 101456. https://doi.org/10.1016/j.jormas.2023.101456

Biswas, S. (2023). ChatGPT and the Future of Medical Writing. *Radiology*, *307*(2), e223312. https://doi.org/10.1148/radiol.223312

BinSaeed, A. A., Torchyan, A. A., Alsadhan, A. A., Almidani, G. M., Alsubaie, A. A., Aldakhail, A. A., AlRashed, A. A., AlFawaz, M. A., & Alsaadi, M. M. (2014). Determinants of Asthma Control Among Children in Saudi Arabia. *Journal of Asthma*, *51*(4), 435–439. https://doi.org/10.3109/02770903.2013.876649

Bernard, M. (2023). Revolutionizing Healthcare: The Top 14 Uses of ChatGPT in Medicine and Wellness. *Forbes*. https://www.forbes.com/sites/bernardmarr/2023/03/02/revolutionizing-healthcare-the-top-14-uses-of-chatgpt-in-medicine-and-wellness/

Cahan, P., & Treutlein, B. (2023). A Conversation with ChatGPT on the Role of Computational Systems Biology in Stem Cell Research. *Stem Cell Reports*, *18*(1–2), 1–416. https://doi.org/10.1016/j.stemcr.2022.12.009

Carter, S. M., Rogers, W., Win, K. T., Frazer, H., Richards, B., & Houssami, N. (2020). The Ethical, Legal and Social Implications of Using Artificial Intelligence Systems in Breast Cancer Care. *The Breast*, *49*, 25–32. https://doi.org/10.1016/j.breast.2019.10.001

Chatterjee, J., & Dethlefs, N. (2023). This New Conversational AI Model can be your Friend, Philosopher and guide and Even Your Worst Enemy. *Patterns*, *4*(1), 100676. https://doi.org/10.1016/j.patter.2022.100676

Clusmann, J., Kolbinger, F. R., Muti, H. S., Carrero, Z. I., Eckardt, J.-N., Laleh, N. G., Löffler, C. M. L., Schwarzkopf, S.-C., Unger, M., Veldhuizen, G. P., Wagner, S. J., & Kather, J. N. (2023). The Future Landscape of Large Language Models in Medicine. *Communications Medicine*, *3*(1), 141. https://doi.org/10.1038/s43856-023-00370-1

Dalal, M. A., Mesa, A. Almahmudi, Jehad, N. A., Mohammed, H. A., Eman, F. A., Modhahir, J. A., & Saleh, A. A. (2024). Is ChatGPT a Reliable Source of Patient Information on Asthma? *Cureus*, *16*(7), e64114. https://doi.org/10.7759/cureus.64114

Darren, C., Dorian, P., Laura, M., Ting, S., Marco, D. R., Bjorn, W. S., Jennifer, Q., Ernie, W., & Rafael, A. C. (2024). A Text-Based Conversational Agent for Asthma Support: Mixed-Methods Feasibility Study. *Digit Health*, *10*(1–18), 20552076241258276. https://doi.org/10.1177/20552076241258276

Dave, T., Athaluri, S. A., & Singh, S. (2023). ChatGPT in Medicine: An Overview of its Applications, Advantages, Limitations, Future Prospects and Ethical Considerations. *Frontiers in Artificial Intelligence*, *6*, 1169595. https://doi.org/10.3389/frai.2023.1169595

Dubin, S., Patak, P., & Jung, D. (2024). Update on Asthma Management Guidelines. *Missouri Medicine*, *121*(5), 364–367.

De Almeida, M. M., Gaspar, Ăngela, & Pinto, J. R. (2001). Epidemiology of Asthma in Portugal, Cape Verde, and Macao. In *Pediatric Pulmonology* (Issue S23, pp. 35–37). https://doi.org/10.1002/ppul.1950262316

Ducharme, F. M., Dell, S. D., Radhakrishnan, D., Grad, R. M., Watson, W. T. A., Yang, C. L., Zelman, M., & SCP et Société Canadienne de Thoracologie. (2015). Le Diagnostic Et La Prise En Charge De L'asthme Chez Les Enfants D'âge Préscolaire : Document De Principes De La Société Canadienne De Thoracologie Et De La Société Canadienne Se Pédiatrie. *Paediatrics and Child Health*, *20*(7), 362–371. https://doi.org/10.1093/pch/20.7.362

Eysenbach, G. (2023). The Role of ChatGPT, Generative Language Models, and Artificial Intelligence in Medical Education: A Conversation with ChatGPT and a Call for Papers. *JMIR Medical Education*, *9*, e46885. https://doi.org/10.2196/46885

Fijačko, N., Gosak, L., Štiglic, G., Picard, C. T., & John Douma, M. (2023). Can ChatGPT Pass the Life Support Exams Without Entering the American Heart Association Course? *Resuscitation*, *185*, 109732. https://doi.org/10.1016/j.resuscitation.2023.109732

Grünebaum, A., Chervenak, J., Pollet, S. L., Katz, A., & Chervenak, F. A. (2023). The Exciting Potential for ChatGPT in Obstetrics and Gynecology. *American Journal of Obstetrics and Gynecology*, *228*(6), 696–705.https://doi.org/10.1016/j.ajog.2023.03.009

Halaseh, F. F., Yang, J. S., Danza, C. N., Halaseh, R., & Spiegelman, L. (2024). ChatGPT's Role in Improving Education Among Patients Seeking Emergency Medical Treatment. *Western Journal of Emergency Medicine*, *25*(5), 845–855. https://doi.org/10.5811/westjem.18650

Hamet, P., & Tremblay, J. (2017). Artificial Intelligence in Medicine. *Metabolism*, *69*, S36–S40. https://doi.org/10.1016/j.metabol.2017.01.011

Holderried, F., Stegemann–Philipps, C., Herschbach, L., Moldt, J.-A., Nevins, A., Griewatz, J., Holderried, M., Herrmann-Werner, A., Festl-Wietek, T., & Mahling, M. (2024). A Generative Pretrained Transformer (GPT)–Powered Chatbot as a Simulated Patient to Practice History Taking: Prospective, Mixed Methods Study. *JMIR Medical Education*, *10*, e53961. https://doi.org/10.2196/53961

Horvat, N., Veeraraghavan, H., Nahas, C. S. R., Bates, David D. B., Ferreira, F. R., Zheng, J., Capanu, M., Fuqua, J. L., Fernandes, M. C., Sosa, R. E., Jayaprakasam, V. S., Cerri, G. G., Nahas, S. C., & Petkovska, I. (2022). Combined Artificial Intelligence and Radiologist Model for Predicting Rectal Cancer Treatment Response from Magnetic Resonance Imaging: An External Validation Study. *Abdominal Radiology*, *47*(8), 2770–2782. https://doi.org/10.1007/s00261-022-03572-8

Jaynes, T. L. (2021). Citizenship as the exception to the rule: An addendum. *AI & SOCIETY*, *36*(3), 911–930. https://doi.org/10.1007/s00146-020-01105-9

Jayakumar, P., Moore, M. G., Furlough, K. A., Uhler, L. M., Andrawis, J. P., Koenig, K. M., Aksan, N., Rathouz, P. J., & Bozic, K. J. (2021). Comparison of an Artificial Intelligence–Enabled Patient Decision Aid vs Educational Material on Decision Quality, Shared Decision-Making, Patient Experience and Functional Outcomes in Adults with Knee Osteoarthritis. *JAMA Network Open*, *4*(2), e2037107. https://doi.org/10.1001/jamanetworkopen.2020.37107

Kam, A. (2023). *La cybersécurité : Pourquoi et comment sécuriser un compte ChatGPT [Internet]*. Digital Mag Côte D'Lvoire: Le Média 100% Digital. https://www.digitalmag.ci/la-cybersecurite-pourquoi-et-comment-securiser-un-compte-chatgpt/

Karabacak, M., & Margetis, K. (2023). Embracing Large Language Models for Medical Applications: Opportunities and Challenges. *Cureus*, *15*(5), e39305. https://doi.org/10.7759/cureus.39305

Kedia, N., Sanjeev, S., Ong, J., & Chhablani, J. (2024). ChatGPT and Beyond: An Overview of the Growing Field of Large Language Models and their use in Ophthalmology. *Eye*, *38*(7), 1252–1261. https://doi.org/10.1038/s41433-023-02915-z

Khan, R. A., Jawaid, M., Khan, A. R., & Sajjad, M. (2023). ChatGPT - Reshaping Medical Education and Clinical Management. *Pakistan Journal of Medical Sciences*, *39*(2), 605–607. https://doi.org/10.12669/pjms.39.2.7653

Kharat, D. A. (2022). Artificial Intelligence and its Role in Healthcare. *Entrepreneur*. https://www.entrepreneur.com/en-in/technology/artificial-intelligence-and-its-role-in-healthcare/427963

Kharbouch, A. (2021). *Chatbots: Definition, Challenges and Good Practices in 2024*. Smart-Tribune. https://blog.smart-tribune.com/fr/chatbots#four

Kitamura, F. C. (2023). ChatGPT Is Shaping the Future of Medical Writing but Still Requires Human Judgment. *Radiology*, *307*(2), e230171. https://doi.org/10.1148/radiol.230171

Koubaa, A., Boulila, W., Ghouti, L., Alzahem, A., & Latif, S. (2023). Exploring ChatGPT Capabilities and Limitations: A Survey. *IEEE Access*, *11*, 118698–118721. https://doi.org/10.1109/access.2023.3326474

Liu, J., Wang, C., & Liu, S. (2023). Utility of ChatGPT in Clinical Practice. *Journal of Medical Internet Research*, *25*, e48568. https://doi.org/10.2196/48568

Lougheed, M. D., Lemiere, C., Ducharme, F. M., Licskai, C., Dell, S. D., Rowe, B. H., FitzGerald, M., Leigh, R., Watson, W., & Boulet, L.-P. (2012). Canadian Thoracic Society 2012 Guideline Update: Diagnosis and Management of Asthma in Preschoolers, Children and Adults. *Canadian Respiratory Journal*, *19*(2), 127–164. https://doi.org/10.1155/2012/635624

Manohar, N., Prasad, S. S., & Pise, G. (2024). ChatGPT: The, The Bad and Everything in Between. *Indian* Good*Dermatology Online Journal*, *15*(1), 166–168. https://doi.org/10.4103/idoj.idoj_274_23

Milne-Ives, M., de Cock, C., Lim, E., Shehadeh, M. H., de Pennington, N., Mole, G., Normando, E., & Meinert, E. (2020). The Effectiveness of Artificial Intelligence Conversational Agents in Health Care: Systematic Review. *Journal of Medical Internet Research*, *22*(10), e20346. https://doi.org/10.2196/20346

Mjid, M., Belloumi, N., Hedhli, A., Toujani, S., Ouahchi, Y., Cherif, J., & Beji, M. (2017). Facteurs Influençant Le Contrôle De L'asthme Chez L'adulte Tunisien. *Revue Française D'Allergologie*, *57*(6), 408–412. https://doi.org/10.1016/j.reval.2017.03.003

Mullins, M., Holland, C. P., & Cunneen, M. (2021). Creating Ethics Guidelines for Artificial Intelligence and Big Data Analytics Customers: The Case of the Consumer European Insurance Market. *Patterns*, *2*(10), 100362. https://doi.org/10.1016/j.patter.2021.100362

Nafti, S., Taright, S., El Ftouh, M., Yassine, N., Benkheder, A., Bouacha, H., Fakhfakh, H., Ali-Khoudja, M., Texier, N., & El Hasnaoui, A. (2009). Control of Asthma in the Maghreb: Results of the AIRMAG Study. *Respiratory Medicine*, *103*, S12–S20. https://doi.org/10.1016/s0954-6111(09)70023-x

Nadarzynski, T., Miles, O., Cowie, A., & Ridge, D. (2019). Acceptability of Artificial Intelligence (AI)-Led Chatbot Services in HealthCare: A Mixed-Methods Study. *Digital Health Care*, *5*. https://doi.org/10.1177/2055207619871808

OCDE. (2019). *Artificial Intelligence in Society* (French Edition). OECD Publishing. https://doi.org/10.1787/b7f8cd16-fr

Ojeda Meixueiro, V. H., Pérez-Campos Mayoral, L., Hernández Huerta, M. T., Matias-Cervantes, C. A., Pérez Campos Mayoral, E., Cruz Parada, E., & Pérez-Campos, E. (2024). Relevance of a Customized Version of ChatGPT Explaining Laboratory Test Results in Patient Education. *Journal of Medical Education and Curricular Development*, *11*. https://doi.org/10.1177/23821205241260239

Palanica, A., Flaschner, P., Thommandram, A., Li, M., & Fossat, Y. (2019). Physicians' Perceptions of Chatbots in Health Care: Cross-Sectional Web-Based Survey. *Journal of Medical Internet Research*, *21*(4), e12887. https://doi.org/10.2196/12887

Pedersen, M., Verspoor, K., Jenkinson, M., Law, M., Abbott, D. F., & Jackson, G. D. (2020). Artificial Intelligence for Clinical Decision Support in Neurology. *Brain Communications*, *2*(2), fcaa096. https://doi.org/10.1093/braincomms/fcaa096

Radanliev, P., Roure, D. D., Maple, C., & Ani, U. (2022). Super-Forecasting the 'Technological Singularity' Risks from Artificial Intelligence. *Evolving Systems*, *13*(5), 747–757. https://doi.org/10.1007/s12530-022-09431-7

Rao, A., Kim, J., Kamineni, M., Pang, M., Lie, W., & Succi, M. D. (2023). Evaluating ChatGPT as an Adjunct for Radiologic Decision-Making. In *MedRxiv*. https://doi.org/10.1101/2023.02.02.23285399

Ravindra, Kumar Garg, Vijeth, L. U., Akshya, A. A., Sarvesh, K. C., Vimal, P., & Sujita, K. K. (2023). Exploring the Role of Chat GPT in Patient Care (Diagnosis and Treatment) and Medical Research: A Systematic Review. *MedRxiv*. https://doi.org/10.1101/2023.06.13.23291311

Sallam, M. (2023). ChatGPT Utility in Healthcare Education, Research, and Practice: Systematic Review on the Promising Perspectives and Valid Concerns. *Healthcare*, *11*(6), 887. https://doi.org/10.3390/healthcare11060887

Shen, Y., Heacock, L., Elias, J., Hentel, K. D., Reig, B., Shih, G., & Moy, L. (2023). ChatGPT and other Large Language Models Are Double-Edged Swords. *Radiology*, *307*(2), e230163. https://doi.org/10.1148/radiol.230163

Singhal, K., Azizi, S., Tu, T., Mahdavi, S. S., Wei, J., Chung, H. W., Nathan, S., Ajay, T., Heather, C.-L., Stephen, P., Perry, P., Martin, S., Paul, G., Chris, K., Abubakr, B., Nathanael, S., Aakanksha, C., Philip, M., Dina, D.-F., Vivek, Natarajan. (2023). Large Language Models Encode Clinical Knowledge. *Nature*, *620*, 172–180. https://doi.org/10.1038/s41586-023-06291-2

Taloni, A., Borselli, M., Scarsi, V., Rossi, C., Coco, G., Scorcia, V., & Giannaccare, G. (2023). Comparative Performance of Humans Versus GPT-4.0 and GPT-3.5 in the Self-Assessment Program of American Academy of Ophthalmology. *Scientific Reports*, *13*(1), 18562. https://doi.org/10.1038/s41598-023-45837-2

van Dis, E. A. M., Bollen, J., Zuidema, W., van Rooij, R., & Bockting, C. L. (2023). ChatGPT: Five Priorities for Research. *Nature*, *614*(7947), 224–226. https://doi.org/10.1038/d41586-023-00288-7

World Health Organization (WHO), Eastern Mediterranean Regional Office (EMRO) Regional Technical Advisory Group (RTAG) on Immunization: Request for Nominations. (2017). *Vaccine*, *35*(13), 1733. https://doi.org/10.1016/j.vaccine.2017.02.054

Xue, V. W., Lei, P., & Cho, W. C. (2023). The Potential Impact of ChatGPT in Clinical and Translational Medicine. *Clinical and Translational Medicine*, *13*(3), e1216. https://doi.org/10.1002/ctm2.1216

You, Y., & Gui, X. (2021). Self-Diagnosis through AI-Enabled Chatbot-Based Symptom Checkers: User Experiences and Design Considerations. *AMIA Annual Symposium Proceedings*, 1354–1363.

Yu, G., Li, Z., Li, S., Liu, J., Sun, M., Liu, X., Sun, F., Zheng, J., Li, Y., Yu, Y., Shu, Q., & Wang, Y. (2020). The role of artificial intelligence in identifying asthma in pediatric inpatient setting. *Annals of Translational Medicine*, *8*(21), 1367. https://doi.org/10.21037/atm-20-2501a