Original Article

Exploring communication challenges with children and parents among pharmacists in Saudi Arabia

A cross-sectional study

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ABSTRACT

الأهداف: تقييم مهارات التواصل لدى الصيادلة في المملكة العربية السعودية مع المرضى الأطفال، و تحديد التحديات والعوامل المرتبطة بأدائهم.

المنهجية: تم إجراء دراسة مستعرضة شملت 170 صيدلياً يعملون في مرافق رعاية صحية مختلفة في المملكة العربية السعودية. تم استخدام استبيانا مكونا من 38 سؤالا، اشتمل على بيانات ديموغرافية، والخلفيات المهنية، ومهارات التواصل. تم إجراء مقارنات الأداء في مهارات التواصل باستخدام اختبار كاي-تربيع، بينما تم دراسة العوامل المؤثرة على أداءهم مع 24 عاملاً باستخدام تحليل الانحدار اللوجستي.

النتائج: أظهرت النتائج أن حوالي 76% من الصيادلة أظهروا أداءً غير مرضٍ في التواصل مع الأطفال (p=8.47×10^{-10}). كما أن أكثر من 91% من الصيادلة اعتمدوا على التحدث مع الآباء بدلاً من التحدث مباشرة مع الأطفال، حتى مع وجود الأطفال (p=7.791×10^{-26}). بالإضافة إلى ذلك، على الرغم من أن 88.23% من الصيادلة أعربوا عن ثقة عالية في مهاراتهم التواصلية (p=9.899×10^{-24})، إلا أن الأداء الفعلي في سيناريوهات تتعلق بفئات عمرية مختلفة للأطفال أظهر أن 63.52% من الصيادلة أدوا أداءً ضعيفاً، بينما أظهر 36.46% فقط أداءً جيداً (p=4.2×10^{-4}). قمنا أيضا باكتشاف بعض العوامل التي قد تكون مؤثرة في أداء الصيادلة عند التواصل مع الأطفال.

الخلاصة: يواجه الصيادلة في المملكة العربية السعودية تحديات كبيرة في التواصل مع المرضى الأطفال. هناك حاجة ماسة إلى تدريب متخصص لتطوير مهارات التواصل لدى الصيادلة، بهدف تعزيز الالتزام بالأدوية وتحسين الحالة الصحية العامة للأطفال.

Objectives: To identify trends and challenges in pharmacists' communication with pediatric patients in Saudi Arabia. It also studies the potential factors affecting their overall performance.

Methods: A cross-sectional survey of 170 pharmacists working in different healthcare settings in Saudi Arabia was carried out. A novel comprehensive 38-item survey questionnaire was utilized. The questionnaire comprised 2 main sections: demographic data and potential influencing factors and communication skills with children. The communication domain assessed the degree to which the pharmacist could communicate with a child in 7 main areas. Comparisons of communication performance were carried out by Chi-square tests, and associations with 24 factors were determined by logistic regression analyses.

Results: Approximately 76% of pharmacists demonstrated unsatisfactory communication with children (p=8.47×10^{-10}). Approximately 91% of pharmacists depended on speaking to parents rather than directly talking to children, even when present (p=7.791×10^{-26}). In addition, although 88.23% of pharmacists expressed high confidence in their communication skills (p=9.899×10^{-24}), their actual performance with children in different age groups showed that 63.52% performed poorly, while only 36.46% demonstrated good performance (p=4.2×10^{-4}). Factors which might be associated with pharmacists' performance were identified.

Conclusion: Pharmacists in Saudi Arabia face significant challenges in communicating with pediatric patients. Targeted training is needed to improve communication skills, medication adherence, and children's health outcomes.

Keywords: pharmacists, communication, pediatric patients, Saudi Arabia

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Effective communication is a key to quality health care, ensuring proper understanding between the patient and the health care provider. It ensures making informed decisions related to treatments and outcomes. Communication helps build a patient's trust, adherence to medical instructions, and overall satisfaction, which is important in enhancing health outcomes. Poor communication leads to misunderstandings, medication errors, and poor adherence, compromising safety and the effectiveness of care.[1]

Pharmacists are an important link in this communication network, providing a connection between the patient and health professionals. The role of pharmacists has continued to evolve from only medication dispensing to include medication counselling, ensuring appropriate drug use, and facilitating adherence. They can identify issues, educate a patient on their medication, and actively engage in discussions that spur patient-centred care. Studies show that effective communication between pharmacists and patients leads to improved adherence and better treatment outcomes, reinforcing their relationship.[2]

Communication becomes increasingly crucial in pediatric care, as a child's cognitive development affects their understanding of health and medication information. Beardsley et al[3] emphasize that pharmacists must tailor communication to a child's cognitive level for better comprehension. However, studies show that pharmacists rarely communicate directly with children, often addressing parents instead.[3] Additionally, many children do not visit pharmacies, limiting pharmacist-child interaction.[4,5] This gap is concerning, as greater involvement could benefit children, particularly those with chronic conditions like asthma. Research on pediatric asthma management found that community pharmacists lack confidence in providing personalized care and communicating with children due to time constraints and inadequate training.[6-8]

Research on pharmacist-child communication is limited, with most studies carried out in community pharmacies in Western countries. There are particularly even fewer studies focusing on hospital visits and on Saudi Arabia, where cultural differences and health challenges can significantly impact interactions. Sin et al[9] examined some factors that influence the provision of clinical paediatric services but did not outline how the attitude and communication practices of pharmacists relating to children influence these services. The lack of relevant literature therefore makes it imperative that the way pharmacists communicate with children be explored further, along with the barriers they encounter in communication.

This study aims to address a significant gap in knowledge regarding pharmacists' communication with children and their parents in Saudi Arabia.

Methods. The survey was carried out from November 2023 to June 2024, using both face-to-face and online methods to engage a broad population of pharmacists in Saudi Arabia. In-person distribution allowed pharmacists to complete the survey on-site in community pharmacies and hospitals, while the online method utilized social media platforms like WhatsApp, X, Telegram, and LinkedIn, allowing pharmacists to respond at their convenience.

To boost response rates, regular follow-up communications were sent, and measures like IP tracking were implemented to prevent multiple submissions. The survey was also shared in pharmacist-focused social media groups to enhance data validity. The research team, being pharmacists by profession, had already undergone an intensive theoretical and practical course on communication skills, of which communication with children was also a part. This gave the research team a solid background to properly explain the survey and maintain a focus on the objectives of the study.

The research was carried out according to ethical standards of, and was approved by, the biomedical research ethics committee, Umm Al-Qura University, Makkah, Saudi Arabia (approval no.: HAPO-02-K-012-2023-11-1862). Prior to survey participation, information on the study, including its objectives, voluntary nature, and confidentiality assurances, was recorded in the introduction of the electronic survey. Participants were required to read this information before proceeding with the survey, ensuring informed consent was obtained implicitly through their voluntary participation. All data were collected and handled anonymously and solely for research purposes. No personally identifiable information was gathered apart from basic demographic data, which was necessary for the analysis. Confidentiality was ensured through secure online platforms, encrypted data transmission, and access restricted to authorized research personnel.

For an ideal presentation of the study, a consensus-based checklist for reporting of survey studies was followed for the entire manuscript.[10]

This is a cross-sectional survey-based study constructed based on the chapter on communication

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with children from the well-regarded reference "communication skills in pharmacy practice".[3] This foundational text provides a comprehensive framework for communication skills with children in pharmacy practice, ensuring the survey is grounded in expert knowledge and industry standards, enhancing the validity of its content.

The survey consists of 2 main sections with a total of 38 questions. Section 1 focuses on demographics and potential influencing factors on communication, containing 22 questions in 5 main categories as shown in Table 1. The variables in this section are descriptive and were not re-classified, but height and weight variables were used to generate 2 other variables, namely, body mass index (BMI, using the formula BMI (kg/m^2) = weight (kg) ÷ height2 (m)) and obesity class based on BMI (underweight of <18.5, normal of 18.5-24.9, overweight of 25-29.9, obesity class I of 30-34.9, obesity class II of 35-39.9, or obesity class III of 40 or more).[11,12] This provides a total of 24 variables (Table 1).

Table 1 - Demographics and potential influencing factors gathered in the survey in 5 main categories.

Categories	No.	Variables
Demographic information	1	Gender
	2	Age group
	3	Nationality
	4	Residence
	5	Marital status
Professional background	6	Workplace
	7	Workplace name
	8	Years of work experience
	9	Educational level
Health and personal characteristics	10	Weight
	11	Height
	12	BMI*
	13	BMI category**
	14	Appearance
	15	Parenting style
	16	Quality of life
Professional practices and confidence	17	Communication skills study
	18	Confidence when communicating with children
	19	Rewards for good communication
	20	Work overload
	21	Work shift impact
	22	Attention loss
Family and economic factors	23	Children
	24	Economic status

*Not included in the survey but was calculated based on weight and height. **Not included in the survey but was calculated based on BMI. BMI: body mass index

Section 2 assesses communication skills when interacting with children through 16 questions in 7 main categories, as shown in Table 2. The multiple answers per question (Appendix 1) were re-classified as "good" or "poor" based on pre-defined ideal answers presented in Table 2. In addition, another variable was produced which measures participant overall performance based on the overall percentage of good answers they provided. Good performers are those who correctly responded to more than half of the questions.

As a clarifying note for the study discussion, reference to a child's parent can be understood to also include an adult guardian.

The target population for this study consisted of pharmacists working in Saudi Arabia. This included those employed in community pharmacies, hospital pharmacies, and medical wards as clinical pharmacists. Exclusion criteria were pharmacists outside SA, those in pharmaceutical companies without direct patient interaction, and non-pharmacist participants.

A convenience sampling method was used for this study. The main outcome of this study was the proportion of pharmacists in Saudi Arabia who had poor communication skills when communicating with children.

The sample size was calculated using Cochran's formula for sample size estimation for proportions: n0=Z2.p. (1-p)/e2 where n0 is the required sample size, Z is the Z-value corresponding to a 95% confidence level (1.96), p is the estimated proportion of pharmacists with poor communication skills (0.5), and e is the accepted margin of error (0.05). Using these parameters, the sample size was calculated with the online Cochran's sample size calculator. The required minimum sample size was determined to be 384 pharmacists.

Although this study has adopted the convenience sampling strategy, the dispersion of the questionnaire through different regions in Saudi Arabia and the use of different recruitment strategies (in-person and through social media) were carried out with the intention of diversifying these samples. Participants are therefore representative of a wide cross-section of pharmacists in Saudi Arabia, from all types of pharmacy, and with diverse experience levels. However, this sample may not be generalized across all pharmacists in the country. Generalization beyond this sample should therefore be carried out with caution.

Statistical analysis. Data analysis was carried out using the R programming language (v4.4.1, 2024-06-14), a recognised tool for statistical analysis. Descriptive statistics were computed to summarise participant demographic data, including frequencies

Table 2 - The measured communication skills in the survey in 7 categories along with the overall pharmacists' performance.

The measured skill	Question measuring the outcome in the survey	Good answers
To whom pharmacists talk the most if a child accompanies their parents?	If the child (the patient) accompanies their parent to the pharmacy to pick up drugs, to whom do you communicate most of the time?	Child but not parent.
What to do if a child did not accompany their parents?	If the child did not accompany their parent to the pharmacy, what do you normally do?	Ask the parent to have the child call the pharmacy, and not ignore the case and talk with the parent only.
Evaluating ability to communicate effectively to different children age groups		
Self-evaluation		
Pharmacists' self-evaluation of their understanding of how to communicate effectively with children in different age groups or different cognitive developmental levels.	Do you know that children of different ages and different cognitive developmental levels understand different aspects of medications and illness?	Yes, I know how to communicate with each different age or each different developmental level.
Study evaluation		
Evaluating understanding "cause-effect" relationship in 3-6-year-old children.	How would you communicate with a 3-6-year-old child on their medication?	This drug will make you better. Take it regularly (at this age, there is no need to explain "why" the drug will make you better).
Evaluating understanding the appropriate expression of dosage frequency to 3-6-year-old children.	If you want to explain to a 3-6-year-old child on the dosage frequency, what will you say?	Take the drug 3 times daily. Your mom will help you to know when to stop the drug (in this age group, avoid complex statements like "every 8 hours" and show that parents will help the child to know when to take and stop the drug as children in this age group cannot be totally independent).
Evaluating understanding "cause-effect" relationship in 7-12-year-old children.	How would you communicate with a 7-12-year-old child on their medication?	This drug will make you better because it will fight bacteria in your body (children in this age group can understand "why" the drug will make them better).
Evaluating understanding of suitable drug information provided to toddlers and pre-school children (3-5 years).	With toddlers and pre-school children (3-5 years), what information do you believe they will understand and need to know on their medicine?	Approximately >50% correct selections (≥4 out of 6 correct options: the drug is for which condition, how it can help the condition, how to take it, its side effects, the importance of complying, and the difference between medicines for children and medicines for adults?). Only 3 correct answers or stating that this information is not suitable for this age group reflects poor answers.
Evaluating understanding of suitable drug information provided to school age children (6-12 years).	With school-age children (6-12 years), what information do you believe they will understand and need to know on their medicine?	Approximately >50% correct selections (≥4 out of 7 correct options: drug ingredients, how it works, how to know it is working, is it used for different illness, are there other drugs for the same illness, and are there different medicines for different illnesses?). Only 3 correct answers or stating "how drugs are made" or "drug-drug interactions" (suitable for older children only) reflect poor answers.
Evaluating understanding of suitable drug information provided to adolescents (13-19 years).	Do you explain the difference between brand and generic medicine to children or adolescents?	Only for adolescents (this kind of information is only suitable for adolescents).
Evaluating understanding of suitable drug information provided to 6-19-year-old children.	You use device demonstrations (such as, show how to use inhalers) with which age group?	6-19-year-old children.
Ways to initiate conversation with children		
How do you generally start the conversation?	When talking to a child in the pharmacy, how would you approach the conversation?	Use icebreakers (namely, talk about his or her favourite games before talking about drugs).
How do you start with a seemingly shy child?	If the child is shy or embarrassed, what do you normally do?	Use icebreakers (namely, talk about his or her favourite games before talking about drugs).
Evaluating to what extent drug-drug and drug-food interactions are explained to adolescents	How often do you tell an adolescent (13-19 years) on the potential of their drug to interact with other drugs or food?	Always, often, or at least sometimes. Never or rarely reflect poor answers
Respecting privacy		
Asking parents for a few minutes alone with a child	How often do you ask parents to give you a few minutes alone with their child to ensure privacy and a quiet area to counsel?	Always, often, or at least sometimes. Never or rarely reflect poor answers.
Not telling parents on sensitive products bought by an adolescent	If adolescents ask you not to tell their parents what they say or buy, what do you usually do?	Obey their request or try to help them communicate with their parents, but not try to tell their parents.
Methods to get a child's attention	If the child or parent appear uninterested or distracted, what do you normally do?	Ask the child for feedback or use visual aids (namely, iPad).
Overall pharmacist performance	Approximately >50% good answers (≥9 out of 16 questions). Approximately ≤50% good answers (≤8 out of 16 questions) reflect poor performers.	

and percentages of categorical data, and means and standard deviations for continuous variables.

Regarding the primary outcome, which was to determine the proportion of pharmacists who possess poor communication skills when relating to children, 2 statistical analyses were used. First, descriptive analysis calculated frequencies and percentages to show the distribution of pharmacists with good and poor communication skills based on survey responses. Second, an exploratory Chi-squared test was applied to determine whether there was a statistically significant difference between the observed proportions of responses for each communication scenario among pharmacists, compared to expected equal proportions (50-50%). While a binomial test confirmed the Chi-squared findings, we chose to report the Chi-squared results for their efficiency and widespread acceptance in categorical data analysis. Results were categorized into the following 3 main groups: I) poor communication skills, reflecting a statistically significant difference (p<0.05) between good and poor answers, most answers being poor. These are the pharmacists that require more effort to improve; II) medium level skills, needing further improvement, but for which no statistically significant difference between good and poor answers is observed (p>0.05, in other words, those for whom the number of positive and negative responses is roughly equal). Some effort to improve such skills is recommended with the aim of achieving a minimum accepted percentage of 80% good performers; and III) skills which can be regarded as good, showing a statistically significant difference (p<0.05) between good and poor responses, most responses being good. Pharmacists in this category do not need to make further efforts to improve.

For the secondary outcome, which was to identify possible associations between any of the 24 explanatory variables and overall pharmacist performance in interacting with children, a binary logistic regression model was used to assess factors associated with poor communication skills, presenting results as odds ratios (ORs) with p-values. To account for multiple comparisons, the Bonferroni adjustment set significance at p<0.002. This conservative method helps control type I errors and ensures rigorous control of false-positive results when testing multiple explanatory variables.

Results. A total of 190 survey responses were received. Nine participants were excluded for not being pharmacists. Of the remaining 181 pharmacists, 12 were also excluded: 8 worked in pharmaceutical companies with no child interaction, and 3 were not practicing in Saudi Arabia. Ultimately, a final sample of 170 responses was analysed (**Figure 1**). Key findings are described below (**Appendix 2**).

Among the 170 pharmacists, 56.47% were male, and 55.29% were aged 20-29 years. Most were Saudi nationals (88.24%), residing mainly in Makkah (33.53%), Riyadh (20.59%), and Jeddah (13.53%). In terms of marital status, 55.88% were single, and 42.35% were married.

Most pharmacists worked in hospital pharmacies (55.88%), followed by community pharmacies (26.47%), and clinical pharmacy roles in medical wards (17.65%). Common workplaces included Al-Nahdi Pharmacy (12.94%) and major hospitals like King Abdulaziz Medical City. Most participants held a bachelor's degree (75.88%), with 28.82% having 2-4 years of experience, while 18.24% had over 10 years.

In terms of BMI, 46.71% of pharmacists had a normal BMI, while 34.73% were overweight. Most rated their appearance as excellent (58.82%) or good (31.76%). Approximately 67.65% felt encouraged to be independent during upbringing, while 24.12% experienced overprotective parenting. Additionally, 51.18% reported being generally happy and satisfied.

Only 12.35% studied child-specific communication skills, while 39.41% took general pharmacy communication courses. Despite this, 36.47% felt confident communicating with children. Notably, 62.94% received no rewards for good communication, and 56.47% felt overloaded at work. Additionally, 51.18% believed they performed better in the morning shifts.

Most pharmacists (59.41%) did not have children, and nearly half (48.24%) reported a moderate monthly income of 7,000-14,000 SAR, while 33.53% reported higher incomes between 15,000-19,000 SAR.

Pharmacists' communication performance across different scenarios was assessed using Chi-square and

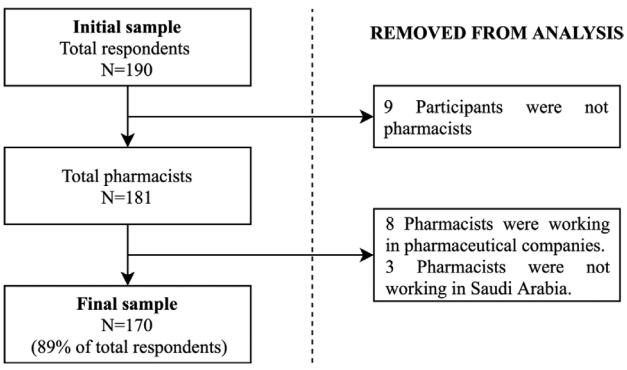

Figure 1 - Flowchart of study participant selection.

Binomial tests, yielding similar results (**Appendix 2**). **Table 3** presents a summary, with key findings outlined below. For further clarification, there are 2 types of 'overall performance' measures used: one summarizing the overall performance in a specific skill (applied to 3 skills - ability to communicate effectively with different age groups, effective conversation initiation, and respecting privacy) and another summarizing the overall performance of pharmacists across all communication scenarios tested in the survey.

If a child was present with a parent, only 8.82% of pharmacists reported communicating primarily with the child and 91.17% with the parent (p=7.79×10^{-26}).

If the child was absent, only 30.58% of pharmacists reported asking the parent to involve the child. Approximately 69.41% of pharmacists reported communicating with the parent alone (p=9.36×10^{-7}).

Pharmacists expressed high confidence in their communication abilities, with 88.23% rating themselves as good (p=9.90×10^{-24}). However, performance in age-specific scenarios revealed significant gaps. For children aged 3-6, only 45.29% could explain the cause-effect relationship of medications appropriately (p=0.242), and 49.41% communicated dosage frequency effectively (p=0.815). In contrast, 64.11% of pharmacists were able to explain these concepts to 7-12-year-olds, while 35.88% gave suboptimal responses (p=2.5×10^{-4}). For toddlers and preschool children (3-5 years), only 5.88% provided suitable drug information, while 94.11% failed to meet age-appropriate communication criteria (p=1.25×10^{-30}). For school-age children (6-12 years), only 6.47% of pharmacists gave appropriate responses (p=7.33×10^{-30}). With adolescents (13-19 years), only 28.23% effectively explained brand versus generic

Table 3 - Poor, moderate , and good communication skills with children among pharmacists in Saudi Arabia along with the Chi-squared test *p*-values.

Measured skills	Good answers	Poor answers	*P*-values	Performance level according to our criteria
To whom pharmacists talk the most if the child accompanies a parent	15 (8.8)	155 (91.2)	7.79×10^{-26}	Poor
What to do if the child did not accompany their parent	52 (30.6)	118 (69.4)	9.36×10^{-7}	Poor
Evaluating ability to communicate effectively to different children age groups				
Self-evaluation				
Pharmacists' self-evaluation of their understanding of how to communicate effectively with children in different age groups and or different cognitive developmental levels.	150 (88.2)	20 (11.8)	9.90×10^{-24}	Good
Actual evaluation				
Understanding "cause-effect" relationship in 3-6-year-old children.	77 (45.3)	93 (54.7)	0.2429083	Moderate
Understanding the appropriate expression of dosage frequency to 3-6-year-old children.	84 (49.4)	86 (50.6)	0.8153346	Moderate
Understanding "cause-effect" relationship in 7-12-year-old children.	109 (64.1)	61 (35.9)	2.53×10^{-4}	Good
Understanding suitable drug information provided to toddlers and pre-school children (3-5 years).	10 (5.9)	160 (94.1)	1.25×10^{-30}	Poor
Understanding suitable drug information provided to school age children (6-12 years).	11 (6.5)	159 (93.5)	7.33×10^{-30}	Poor
Understanding suitable drug information provided to adolescents (13-19 years).	48 (28.2)	122 (71.8)	1.32×10^{-8}	Poor
Understanding suitable drug information provided to 6-19-year-old children	95 (55.9)	75 (44.1)	0.1391008	Moderate
Overall actual performance across different age groups	62 (36.5)	108 (63.5)	4.2×10^{-4}	Poor
Ways of initiating conversation with children				
How do you generally start the conversation?	81 (47.6)	89 (52.3)	0.5857884	Moderate
How do you start with a seemingly shy child?	78 (45.9)	92 (54.1)	0.3115148	Moderate
Overall performance regarding conversation initiation	~80 (46.8)	~91 (53.2)	0.4002	Moderate
Evaluating to what extent drug-drug and drug-food interactions are explained to adolescents	150 (88.2)	20 (11.8)	2.02×10^{-24}	Good
Respecting privacy				
Asking parents for a few minutes alone with the child	89 (52.3)	81 (47.6)	0.4835221	Moderate
Not telling parents regarding sensitive products bought by an adolescent	80 (47.0)	90 (52.9)	0.5857884	Moderate
Overall performance regarding respecting privacy	~85 (50.0)	~86 (50.0)	0.939	Moderate
Methods to get the child's attention	106 (62.3)	64 (37.6)	8.15×10^{-4}	Good
Overall pharmacists' performance across all communication scenarios	41 (24.1)	129 (75.9)	8.48×10^{-10}	Poor

Values are presented as numbers and percentages (%).

medications ($p<1.32\times10^{-8}$), and 55.88% guided device use like inhalers ($p=0.139$). Overall, 63.52% of pharmacists performed poorly across all communication skills related to these age groups ($p=4.2\times10^{-4}$).

Pharmacists' ability to initiate conversations with children was evaluated, revealing that only 47.64% used effective techniques ($p=0.585$). For shy children, 45.88% utilized appropriate conversation strategies ($p=0.311$). Overall, 46.76% of pharmacists initiated conversations effectively, while 53.23% did not ($p=0.4002$).

In discussing drug-drug and drug-food interactions with adolescents, 88.23% of pharmacists reported explaining these interactions regularly, while 11.76% did not ($p=2.02\times10^{-24}$).

Pharmacists asked for time alone with children in 52.35% of cases ($p=0.483$). Regarding adherence to adolescents' requests not to disclose sensitive information to parents, only 47.05% of pharmacists respected these requests ($p=0.585$). The combined results in this category indicated that approximately 50% of pharmacists respected children's privacy, while 50% did not ($p=0.939$).

Strategies such as visual aids were used by 62.35% of pharmacists, while 37.64% did not incorporate engagement techniques ($p=8.1\times10^{-4}$).

Only 24.11% of pharmacists were classified as good performers, whereas 75.88% performed poorly across all evaluated scenarios ($p=8.48\times10^{-10}$).

A binary logistic regression model assessed 24 potential factors influencing pharmacist performance. After Bonferroni correction ($p<0.002$), no variable showed a statistically significant association. However, 8 factors were nominally significant ($p<0.05$): city, age, obesity, physical appearance, parenting style, studying communication skills with children, confidence, and working hours.

Pharmacists in Jeddah, Saudi Arabia, were 2.6 times less likely to perform poorly than those in Makkah ($p=4.4\times10^{-2}$). Pharmacists aged 40-49 ($p=3.53\times10^{-2}$) and those with obesity class III ($p=4.67\times10^{-2}$) were 5 times less likely to perform poorly than younger pharmacists and those with ideal body weight. Those rating their appearance as excellent were twice as likely to perform well as those rating themselves as good ($p=4.34\times10^{-2}$). Parenting style also played a role; those who received discouraging statements were 3 times more likely to perform poorly ($p=2.87\times10^{-2}$). Those who took only general communication courses or none were 3-3.6 times more likely to perform poorly compared to those who studied child-specific communication ($p=3.77\times10^{-2}$ and $p=4.72\times10^{-2}$). Lastly, lower confidence and a preference for morning shifts, rather than being unaffected by working times, were also linked to poorer performance.

Table 4 summarizes all the potentially important findings.

Discussion. This study highlights some of the major communication challenges encountered by pharmacists in Saudi Arabia when communicating with children. A majority of participants (~76%) exhibited low overall communication performance in various scenarios with paediatric patients. Most importantly, only 9% of participant pharmacists in Saudi Arabia primarily addressed children during communication, less than that reported by Nilaward et al[13] who found 20.2% of pharmacists to directly engage children. Not engaging children in communication limits the opportunity of a child to understand their medication, which is important for health literacy and ownership of personal health.

The results also showed that, in the absence of the child, 69.41% of the pharmacists communicated exclusively with the parents while only 30.58% attempted to engage the child over the phone or another medium. This further restricts the child from being engaged in discussions regarding their medicines, reducing their interest and understanding of crucial information on treatment. This is a critical gap in communication by pharmacists, highlighting the need for approaches which, even in the absence of the child, engage them in discussions regarding their health.

A critical result of the current study is the difference between self-reported confidence and actual communication performance. While 88.23% of the responding pharmacists reported confidence to communicate effectively with children in different age groups, the actual assessment showed significant gaps in their capability to explain essential medication-related concepts, most significantly to a younger child. These findings agree with those of Nilaward et al,[13] which suggest that perceived and actual communication capabilities among pharmacists do not always agree.

Furthermore, this study finds that it is difficult for pharmacists to provide information on drugs which is appropriate for the child's age. Only 5.88% of the pharmacists provided appropriate information for toddlers and preschool children aged 3-5 years, while 94.11% provided unsatisfactory information. Also, for the school children aged 6-12 years, only 6.47% of the pharmacists gave appropriate responses. Indeed, these findings raise concern at every stage of a child's development since children require information on medication adjusted to their cognitive ability, even if

Table 4 - Explanatory variables with nominal significant associations with overall pharmacist performance when communicating with children.

Variables	Estimate	Std. error	z value	Pr(>|z|)
Cities				
(Intercept)	1.12214	0.30771	3.647	0.000266
Jeddah	-0.97904 (OR=2.66)	0.48813	-2.006	$4.49\times10^{-2*}$
Other cities†				>0.05
Age (years)				
(Intercept)	1.10E+00	2.27e-01	4.851	0.0000012
30-39	2.06E-02	3.66e-01	0.056	0.9551
40-49	-1.61E+00 (OR=5)	7.65e-01	-2.105	$3.53\times10^{-2*}$
50-59	-3.72E-15	1.18e+00	0	1
Obesity				
(Intercept)	1.3257	0.2729	4.859	1.18e-06
Obesity class I	-0.6325	0.5696	-1.11	0.2668
Obesity class II	14.2404	1029.1215	0.014	0.989
Obesity class III	-1.6134 (OR=5)	0.811	-1.989	$4.67\times10^{-2*}$
Overweight	-0.4319	0.3908	-1.105	0.2692
Underweight	0.6202	1.1033	0.562	0.574
Physical appearance				
(Intercept)	1.5686	0.3476	4.513	6.4e-06
Excellent	-0.8183 (OR=2.26)	0.4051	-2.02	$4.34\times10^{-2*}$
Fair	-0.1023	0.7288	-0.14	0.8884
Poor	-16.1347	882.7434	-0.018	0.9854
Parenting				
(Intercept)	0.7673	0.1938	3.96	7.51e–05
They frequently say "don't do that, this could be harmful for you. We will do it for you".	1.0519 (OR=2.86)	0.4809	2.187	$2.87\times10^{-2*}$
They just don't care most of the time. They let you do whatever you want.	0.619	0.674	0.919	0.3583
Studied communication skills for children?				
(Intercept)	0.1823	0.4282	0.426	0.6702
Yes, but I did not study a topic on communications' skills for children.	0.7732	0.5026	1.539	0.1239
I took a communication skills course not specifically directed to pharmacists.	1.1029 (OR=3)	0.5306	2.079	$3.77\times10^{-2*}$
No	1.2993 (OR=3.6)	0.6548	1.984	$4.72\times10^{-2*}$
Confidence				
(Intercept)	0.5188	0.2526	2.054	0.0400
Fairly confident	0.8922 (OR=2.44)	0.4338	2.057	$3.97\times10^{-2*}$
Not confident at all	15.0473	1029.1215	0.015	0.9883
Slightly confident	0.1744	0.5273	0.331	0.7409
Somewhat confident	1.2158 (OR=3.37)	0.5098	2.385	$1.71\times10^{-2*}$
Working time				
(Intercept)	0.5819	0.2864	2.032	0.0422
I feel better at night.	-0.1119	0.638	-0.175	0.8607
I feel better in the afternoon.	0.3054	0.5327	0.573	0.5664
I feel better in the morning.	0.8889 (OR=2.43)	0.3929	2.262	$2.37\times10^{-2*}$
Other 16 explanatory variables*				
NA	NA	NA	NA	>0.05

†Abha, Al-Ahsaa, Al-Bahah, Al Kharj, Aldawadmi, Alkhober, Riyadh, Bahrah, Buraydah, Dammam, Dhahran, Hail, Fifa, Jazan, Madina, Khamis Mushait, Mubarraz, Najran, Neom, Rafha, Qassim, Qatif, Sakaka, Tabuk, Taif, Tayma.
*The reference level for the outcome variable: "Good" overall performance.
**For all other explanatory variables, review Table 1.
Reference levels for the 8 explanatory variables are: I) Makkah, II) 20-29, III) normal, IV) good, V) you can do it, we will support you, VI) studied CSs with children, VII) completely confident, and VIII) not affected by working time.

a parent is present during the consultation.[14] A lack of adjustment to age may lead to a child failing to comprehend their ailment or treatment, especially in chronic diseases where early education is investment for long-run adherence and independence.

Another communication shortfall identified in the survey was that only 28.23% of the responding pharmacists explained the differences between brand and generic medicines to adolescents. This knowledge is important to enable a patient to make sound decisions regarding their care, and an adolescent can be expected to start to take responsibility for their own health. Secondly, although 55.88% of the responding pharmacists demonstrated proper use of devices like inhalers, 44.11% failed to do so, revealing another gap for adolescents who suffer from chronic conditions such as asthma.

Another important gap pertained to respect for the privacy of adolescents during consultations. Only 50% of the responding pharmacists always asked for time with adolescent patients alone or respected the request of the patient not to disclose sensitive information with others. The other half did not exercise these techniques, which might prevent effective communication between the pharmacist and the adolescent patient. Respecting patients' privacy is a significant ingredient for trust and will be very important to an adolescent, particularly since it can affect compliance with treatment.

Encouragingly, pharmacists were more positive in using methods to hold a child's attention during consultation. The cumulative percentage of pharmacists who used methods like visual aids or interactive feedback for maintaining focus, an important component of effective communication, was 62.35%. However, such methods were not used by 37.64% of the pharmacists, leaving scope for improvement in the domain of making communication engaging and child-friendly. Pharmacists can build a trusting relationship by beginning a conversation with questions on their favourite movie or game. This can help both parties feel more comfortable and encourage the child's interaction with someone they are not familiar with.[15]

The study also identified 8 variables nominally associated with communication performance, including city, age, obesity class, physical appearance, parenting style, prior education in communication skills, confidence, and working hours. Pharmacists in Jeddah, Saudi Arabia, performed better than those in Makkah, Saudi Arabia. This may be due to better training or infrastructure. Pharmacists aged 40-49 years performed better than younger ones, likely due to more experience in using different communication strategies. Surprisingly, pharmacists with obesity class III were less likely to perform poorly than those with an ideal BMI, a result that warrants further exploration.

Confidence, both in communication skills and physical appearance, was positively associated with performance, reinforcing previous findings regarding the important role that confidence plays in effective communication.[16] Pharmacists who reported hearing discouraging words from their parents performed worse, supporting other research that links overprotective parental behaviours to maladaptive outcomes in adolescents.[17] Lastly, pharmacists who had studied communication skills specifically aimed at interactions with children performed better, indicating the importance of targeted training in developing effective communication skills.

Study limitations. The questionnaire, while developed based on established communication frameworks and reviewed by experts for content validity, was not piloted in a smaller sample before full implementation. Future studies may consider carrying out additional validation procedures to confirm its reliability. In addition, the use of the convenience sampling method limits the generalizability of the results. While the sample included pharmacists from different regions of Saudi Arabia, it may not fully capture the diversity of the broader pharmacist population with potential regional differences in healthcare infrastructure and training. Moreover, due to limited study period, only 170 pharmacists were recruited, despite extensive efforts to maximize participation, which is smaller than the calculated target sample size. However, this was sufficient for our primary outcome, which was exploratory in nature and aimed to identify trends in pharmacists' communication behaviours with children. Although the smaller sample size may limit statistical power for secondary outcomes, the findings offer valuable exploratory insights. Future research with larger sample sizes is recommended to validate these associations and enhance statistical robustness.

Special attention should be given to the development of tailored training programs that equip pharmacists with the skills needed to engage children effectively, provide age-appropriate information, and respect adolescents' privacy. Assessing the impact of such interventions on health outcomes in paediatric populations will be critical in determining their efficacy. Additionally, understanding the cultural and contextual factors influencing pharmacist-child interactions in SA is essential for designing culturally appropriate communication strategies that align with local healthcare practices.

In conclusion, this study reveals significant deficiencies in pharmacists' communication with child patients in Saudi Arabia, with most interactions focused on parents rather than the paediatric patients themselves. Despite high self-reported confidence, actual communication performance, particularly in providing age-appropriate information, was lacking. Addressing these gaps through targeted training is essential for enhancing pharmacists' ability to engage children effectively and to improve paediatric health outcomes. By fostering more inclusive, child-centred communication, pharmacists can play a crucial role in empowering young patients to take responsibility for their own health.

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Appendix 1 - Survey questionnaire.

Section 1: Demographic data and potential influencing factors

1. **Where are you working?**
   - In a community pharmacy.
   - In a hospital pharmacy.
   - In medical wards as a clinical pharmacist.
2. **What is the name of your workplace?**

   _____
3. **Where do you live?**

   _____
4. **Nationality:**
   - Saudi
   - Egyptian
   - Sudanese
   - Syrian
   - Other: _____
5. **Gender:**
   - Male
   - Female
6. **Age group:**
   - 20-29
   - 30-39
   - 40-49
   - 50-59
   - 60 or more
7. **Weight: (kg)**

   _____
8. **Height: (cm)**

   _____
9. **How do you rate your general appearance?**
   - Excellent
   - Good
   - Fair
   - Poor
   - Bad
10. **Marital status:**
    - Married
    - Single
    - Divorced
    - Widowed
11. **How do you think you were raised by your parents?**
    - They frequently say: don't do that, this could be harmful for you. We will do it for you.
    - They frequently say: you can do this, try and we will support you if you need.
    - They just don't take care most of the time. They let you do whatever you want.
12. **Economic status:**
    - Very high monthly income (20,000 SAR or more).
    - High monthly income (15,000-19,000 SAR).
    - Moderate monthly income (7000-14,000 SAR).
    - Poor monthly income (6000 SAR or less).
13. **How do you evaluate your quality of life?**
    - Very happy and satisfied most of the time.
    - Happy and satisfied in general.
    - Moderate happiness and satisfaction.
    - Poor happiness and satisfaction.
    - I have been through chronic stress, and I have been treated or I think I need to be treated for some potential psychological illnesses.
14. **Educational level:**
    - Bachelor's degree
    - Master's degree or PGY1
    - PhD degree or PGY2
15. **Years of work experience:**
    - 0-1 years
    - 2-4 years
    - 5-10 years
    - More than 10 years
16. **Did you study communication skills in pharmacy practice course?**
    - No
    - I studied general communication skills course which is not specifically directed to pharmacists.
    - Yes, but I did not study a topic on communications' skills with children.
    - Yes, and I studied communication skills with children.
17. **In a pharmacy setting, how confident are you regarding your communication with children and or parents?**
    - Not confident at all
    - Slightly confident
    - Somewhat confident
    - Fairly confident
    - Completely confident
18. **Do you get a reward from your pharmacy manager regarding your good communication and patient satisfaction?**
    - Yes
    - No
19. **Do you think that you are generally overloaded, so you do not have enough time to communicate with patients?**
    - Yes, most of the time
    - Sometimes
    - Not at all
20. **Does the time of your shift (morning, afternoon, or night) affect your ability to communicate?**
    - Yes, I feel better in the morning.
    - Yes, I feel better in the afternoon.
    - Yes, I feel better at night.
    - Not at all
21. **Do you feel you are losing the attention you give to patients as work hours pass?**
    - Yes
    - No
22. **Do you have children of your own?**
    - Yes
    - No

Section 2: Communication skills' questions

1. **If children (who are patients) accompany their parents to pharmacy to pick up drugs, to whom you communicate most of the time?**
   - Parents
   - Their children
2. **Do you know that children in different ages and different cognitive developmental levels understand different aspects of medications and illness?**
   - No. I communicate the same with all children.
   - Yes, I know how to communicate with each different age or each different developmental level.
3. **How would you communicate with a 3-6 years-old child about his medications?**
   - This drug will make you better because it will fight bacteria in your body.
   - This drug will make you better. Take it regularly.
   - I cannot see any difference; I would use any of the above statements.
4. **If you want to explain to a 3-6 years-old child on the dosage frequency, what will you say?**
   - Take the drug three times daily. Your mom will help you to know when to stop the drug.
   - Take the drug every 8 hours daily. Your mom will help you to know when to stop the drug.
   - Take the drug every 8 hours daily. Work with your mom so you both know when to stop the drug.
   - Take the drug three times daily until the 2nd of November.

- o I cannot see any difference; I would use any of the above statements.

5. How would you communicate with a 7-12 years-old child on his medications?
- o This drug will make you better because it will fight bacteria in your body.
- o This drug will make you better as it will improve your immune system via killing E.coli bacteria causing your illness.
- o I cannot see any difference; I would use any of the above statements.

6. When talking to a child in the pharmacy, how would you approach the conversation?
- o Ask about his/her favorite game before talking about drugs.
- o Ask simple "yes" or "no" questions about his/her drugs before talking about drugs.
- o I would not approach the conversation; I will ask him/her to call his/her parent.

7. With toddlers and pre-school children (3-5 years), what information do you believe they will understand and need to know about their medicine?
- □ Why they should take it.
- □ How to take it.
- □ Its therapeutic purpose.
- □ Side effects.
- □ Importance of complying with its regimen.
- □ The difference between medicines for children and medicines for adults.
- □ The child is too young for such information.

8. With school-age children (6-12 years), what information do you believe they will understand and need to know about their medicine?
- □ Its ingredient.
- □ Its mechanism (how it works).
- □ Is it working?
- □ How they are made.
- □ Potential for interactions.
- □ Is it used for different illnesses?
- □ Are there other medicines for the same illness?
- □ Are there different medicines for different illnesses?
- □ Device demonstrations (namely, how to use inhalers).

9. How often did you tell an adolescent (13-19 years) about the potential of their drug interactions with other drugs or food?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

10. If adolescents, ask you not to tell their parents/guardians what they say or buy, usually you…
- o Ignore their request.
- o Obey their request.
- o Ask them for a reason, then decide whether to ignore or obey.
- o Try to help them communicate with their parents/guardians.

11. Do you explain the difference between brand and generic medicine for children or adolescents?
- o No, I do not think they should know.
- o I did not have the chance, but I will.
- o Yes, I believe they should know.
- o Only for adolescents.

12. You use device demonstrations (namely, show how to use inhalers) method with:
- o Children (< 3 years).
- o Children (3-5 years).
- o Children (6-12 years).
- o Adolescent (13-19 years).
- o I do not use it.

13. If children did not accompany their parents/guardians to the pharmacy, what do you normally do? (please select what you do but not what you think to be true)
- o Discuss medication with their parents/guardians only.
- o Ask the parent/guardians to have the child call the pharmacy.

14. If the child and or parent appear uninterested or distracted, what do you normally do? (please select what you do but not what you think to be true)
- o Assume they know their medication.
- o Hurry in counseling even if they appear uninterested.
- o Ask them for feedback.
- o Use visual aids (e.g., iPads with medical educational games, colorfully written materials, or demonstrative devices).
- o Other: _____

15. How often do you ask parents to give you a few minutes alone with their child to ensure privacy and a quiet area to counsel?
- o Always
- o Often
- o Sometimes
- o Rarely
- o Never

16. If the child were shy or embarrassed, what do you normally do? (please select what you do but not what you think to be true)
- o Assume they prefer me to talk to their parents.
- o Just tell them the information they need to hear.
- o Initiate the conversation with icebreakers (e.g., ask them to talk to you about their favorite game or cartoon movie).

--- Extra open questions (not for the purpose of evaluating performance)-----

1. In general, what is the age group you find the hardest to communicate with?
- a. Children (< 3 years).
- b. Children (3-5 years).
- c. Children (6-12 years).
- d. Adolescent (13-19 years).
- e. I do not have any difficulty.

2. From your work experience, what do you think is the most common barrier/s for communication with children?
- □ Pharmacists are not aware about the importance of communication with children.
- □ Children are not usually accompanying their parents to pharmacies.
- □ The child being shy.

3. Please feel free if you want to share more about your experience (optional)

Appendix 2A - Detailed statistical results.

Explanatory variables	n (%)
(1) Where are you working ?	
In a hospital pharmacy	95 (55.9)
In a community pharmacy	45 (26.5)
In medical wards as a clinical pharmacist	30 (17.6)
Total	170 (100)
(2) What is the name of your workplace	
Al-Nahdi	22 (12.9)
Al-Dawa Pharmacy	7 (4.1)
King Abdulaziz Medical City, national gurad	7 (4.1)
Prince Sultan Military Medical City	7 (4.1)
King salman specialist hospital·	6 (3.5)
Alhabib Medical Group	5 (2.9)
King Saud University Medical City	4 (2.3)
Maternaty and Childern Hospital	4 (2.3)
MOH	4 (2.3)
Almoosa health group	3 (1.8)
Faisal pharmacy	3 (1.8)
Hera General Hospital	3 (1.8)
King Abdulaziz Hospital	3 (1.8)
King Fahad hospital	3 (1.8)
King Faisal Hospital - Makkah	3 (1.8)
King Faisal specialist hospital and research center Jeddah	3 (1.8)
MCH	3 (1.8)
Alhada military hospital	2 (1.2)
Fifa General Hospital	2 (1.2)
KAAUH	2 (1.2)
KAMC	2 (1.2)
Lamon pharmacy	2 (1.2)
Military hospital	2 (1.2)
Prince muteb hospital·	2 (1.2)
Prince Saud bin Jalawy Hospital	2 (1.2)
Qatif central hospital·	2 (1.2)
United pharmacy·	2 (1.2)
Abha international private hospital·	1 (0.6)
Adam medical group	1 (0.6)
Adam pharmacy	1 (0.6)
AKMICH	1 (0.6)
Al Hada Armed Forces Hospital	1 (0.6)
Al Salama Hospital	1 (0.6)
Alaffary medical clinic	1 (0.6)
Albadr Developed Medical Group	1 (0.6)
Almana hospital	1 (0.6)
Almoujtma	1 (0.6)
Alsaady pharmacy	1 (0.6)
Alzafer hospital	1 (0.6)
Amwaj Ageeli	1 (0.6)
Andalusia	1 (0.6)
Aomori	1 (0.6)
Aseel med pharmacy·	1 (0.6)
Aseer Central Hospital·	1 (0.6)
Dammam medical complex	1 (0.6)
Davita	1 (0.6)
Dawadmi general hospital·	1 (0.6)
DMC	1 (0.6)
Dr Sulaiman Al Habib·	1 (0.6)
Dr. Erfan & Bagedo General Hospital	1 (0.6)
Dr.soliman fakeeh hospital	1 (0.6)
Eastern Health cluster·	1 (0.6)
EHC	1 (0.6)

Appendix 2A - Detailed statistical results (continuation).

Explanatory variables	n (%)
(2) What is the name of your workplace	
Extended care·	1 (0.6)
General directorate of health affairs in Tabuk	1 (0.6)
Ghaya pharmacy	1 (0.6)
Hammadi Pharmacy	1 (0.6)
Health & beautify pharmacy·	1 (0.6)
I Brand pharmacy·	1 (0.6)
Ibrand	1 (0.6)
HMG	1 (0.6)
Kaah	1 (0.6)
KASH-Taif	1 (0.6)
KFMC	1 (0.6)
King Abdullah medical cmoplex-Jeddah	1 (0.6)
King faisal medical complex	1 (0.6)
King khaled university hospital	1 (0.6)
King Khalid hospital-Tabuk	1 (0.6)
Lama lab pharmacy·	1 (0.6)
MCH/Makkah cluster·	1 (0.6)
MMC	1 (0.6)
National care hospital	1 (0.6)
Neom hospital	1 (0.6)
Noon medical center	1 (0.6)
Prince Sultan Cardiac Center	1 (0.6)
Private sector	1 (0.6)
Qilwah general hospital·	1 (0.6)
Sami Ghanem pharmacy	1 (0.6)
Saudi German Hospital·	1 (0.6)
Security Forces Hospital	1 (0.6)
SFH	1 (0.6)
SFHM	1 (0.6)
SGH	1 (0.6)
Tayma General Hospital	1 (0.6)
The Specialist Hospital·	1 (0.6)
University of tabuk	1 (0.6)
Whites Pharmacy	1 (0.6
Total	170 (100)
(3) Where do you live?	
Makkah	57 (33.5)
Riyadh	35 (20.6)
Jeddah	23 (13.5)
Abha	4 (2.3)
Al-Ahsaa	4 (2.3)
Dammam	4 (2.3)
Eastern province	4 (2.3)
Tabuk	4 (2.3)
Taif	4 (2.3)
Al-Bahah	3 (1.8)
Madina	3 (1.8)
Al Kharj	2 (1.2)
Hail	2 (1.2)
Fifa	2 (1.2)
Khamis Mushait	2 (1.2)
Najran	2 (1.2)
Rafha	2 (1.2)
Qassim	2 (1.2)
Aldawadmi city	1 (0.6)
Alkhober	1 (0.6)
Bahrah	1 (0.6)
Buraydah	1 (0.6)
Dhahran	1 (0.6)
Jazan	1 (0.6)

Appendix 2A - Detailed statistical results (continuation).

Explanatory variables	n (%)
(3) Where do you live?	
Mubarraz	1 (0.6)
Neom	1 (0.6)
Qatif	1 (0.6)
Sakaka	1 (0.6)
Tayma	1 (0.6)
Total	170 (100)
(4) Nationality	
Saudi	150 (88.2)
Egyptian	13 (7.6)
Jordanian	2 (1.2)
Syrian	2 (1.2)
Palestinian	1 (0.6)
Sudanese	1 (0.6)
Yemen	1 (0.6)
Total	170 (100)
(5) Gender	
Male	96 (56.5)
Female	74 (43.5)
Total	170 (100)
(6) Age group	
20 - 29	94 (55.3)
30 - 39	65 (38.2)
40 - 49	8 (4.7)
50 - 59	3 (1.8)
Total	170 (100)
(7) Body mass index category	
Normal	78 (46.7)
Overweight	58 (34.7)
Obesity class I	15 (9.0)
Obesity class III	7 (4.2)
Underweight	7 (4.2)
Obesity class II	2 (1.2)
Total	167 (100)
(8) How do you rate your general appearance ?	
Excellent	100 (58.8)
Good	54 (31.8)
Fair	15 (8.8)
Poor	1 (0.6)
Total	170 (100)
(9) Marital status	
Single	95 (55.9)
Married	72 (42.3)
Divorced	2 (1.2)
Widowed	1 (0.6)
Total	170 (100)
(10) How you was raised by your parents?	
They frequently say " don't do that, we will do it for you"	41 (24.1)
They frequently say "You can do it, we will support you"	151 (67.6)
Thay just don't take care most of the time, let you do whatever you want	14 (8.2)
(11) Economic status	
Moderate monthly income (7000-14,000 SAR).	82 (48.2)
High monthly income (15,000-19,000 SAR).	57 (33.5)
Very high monthly income (20,000 SAR or more).	22 (12.9)
Poor monthly income (6000 SAR or less).	9 (5.3)
(12) How do you evaluate your quality of life?	
Happy and satisfied in general	87 (51.2)
Very happy and satisfied most of the time	41 (24.1)
Moderate happiness and satisfaction	35 (20.6)

Appendix 2A - Detailed statistical results (continuation).

Explanatory variables	n (%)
(12) How do you evaluate your quality of life?	
I have been through chronic stress, and I have been treated or I think I need to be treated for some potential psychological illnesses.	7 (4.1)
Poor happiness and satisfaction.	0 (0.0)
Total	170 (100)
(13) Educational level ?	
Bachelor's degree	129 (75.9)
Master's degree or PGY1	33 (19.4)
PhD degree or PGY2	8 (4.7)
Total	170 (100)
(14) Years of work expereicne	
2-4 years	49 (28.8)
5-10 years	48 (28.2)
0-1 years	42 (24.7)
More than 10 years	31 (18.2)
Total	170 (100)
(15) Did you study communication skills in pharmacy practice?	
Yes, but I did not study a topic on communication skills with children	67 (39.4)
Yes, but I studied general communication skills which is not directed to pharamcists	57 (33.5)
No	25 (14.7)
Yes, and I studied communication skills with children	21 (12.3)
(16) Are you confedinet when talking with children?	
Compeletely confiednet	62 (36.5)
Fairly confiednet	48 (28.2)
Not confiednet	2 (1.2)
Slightly confiednet	20 (11.8)
Somewhat confiednet	38 (22.3)
Total	170 (100)
(17) Do you get rewards from your managesrs on good communication?	
No	107 (62.9)
Yes	63 (37.1)
Total	170 (100)
(18) Often overloaded ? No time for communication?	
Sometimes	96 (56.5)
Yes, most of the time	38 (22.3)
Not at all	36 (21.2)
Total	170 (100)
(19) Does working in the night or day affect your ability to wrok?	
Yes, I feel better in the morning	87 (51.2)
Not at all	48 (28.2)
Yes, I feel better in the afternoon	22 (12.9)
Yes, I feel better at night	13 (7.6)
Total	170 (100)
(20) Do you lose attention as working hours pass?	
No	79 (46.5)
Yes	91 (53.5)
Total	170 (100)
(21) Do you have children ?	
No	101 (59.4)
Yes	69 (40.6)
Total	170 (100)

Appendix 2B - Characteristics of study participants and potential influencing factors (continuous variables).

Stat measure	Body mass index	Height (cm)	Weight (kg)
Mean	27.4	165.93	71.59
Standard deviation	21.63	13.42	18.51
Minimum	17.78	74	39
Q1	22.23	160	59
Median	24.61	168	70
Q3	27.22	174	80
Maximum	271.87	187	174

Appendix 2C - Percentages of "good" and "poor" answers to various communication skills questions along with the percentages of "good" and "poor" performers of pharmacists (categorical variables).

Outcome variables	n (%)
(1) Talking mostly to children or parents about medicine	
Good	15 (8.8)
Poor	155 (91.2)
Total	170 (100)
(2) Understanding different cognitive levels	
Good	150 (88.2)
Poor	20 (11.8)
Total	170 (100)
(3) Communicate to 3-6 years old children about medicine (evaluating understanding cause-effect relationship)	
Good	77 (45.3)
Poor	93 (54.7)
Total	170 (100)
(4) Communicate to 3-6 years old children about dosage frequency	
Good	84 (49.4)
Poor	86 (50.6)
Total	170 (100)
(5) Communicate to 7-12 years old children about medicine (evaluating understanding cause-effect relationship)	
Good	109 (64.1)
Poor	61 (35.9)
Total	170 (100)
(6) Initiating conversations with a child	
Good	81 (47.6)
Poor	89 (52.3)
Total	170 (100)
(7) Information for children 3-5 years old	
Good	10 (5.9)
Poor	160 (94.1)
Total	170 (100)
(8) Information for children 6-12 years old	
Good	11 (6.5)
Poor	159 (93.5)
Total	170 (100)
(9) Adolescent drug-drug reactions and adverse effects	
Good	150 (88.2)
Poor	20 (11.8)
Total	170 (100)
(10) Respecting adolescent's privacy	
Good	80 (47.0)
Poor	90 (52.9)
Total	170 (100)
(11) Explaining difference between brand and generic names	
Good	48 (28.2)
Poor	122 (71.8)
Total	170 (100)

Appendix 2C - Percentages of "good" and "poor" answers to various communication skills questions along with the percentages of "good" and "poor" performers of pharmacists (categorical variables, continuation).

Outcome variables	n (%)
(12) Device demonstration at different ages	
Good	95 (55.9)
Poor	75 (44.1)
Total	170 (100)
(13) Wha to do if child not in the pharmacy	
Good	52 (30.6)
Poor	118 (69.4)
Total	170 (100)
(14) Solutions to capture a child's attention	
Good	106 (62.3)
Poor	64 (37.6)
Total	170 (100)
(15) Asking for a few minutes alone for privacy	
Good	89 (52.3)
Poor	81 (47.6)
Total	170 (100)
(16) Initiating conversations with a shy child	
Good	78 (45.9)
Poor	92 (54.1)
Total	170 (100)
(17) Overall performance per pharmacist	
Good	41 (24.1)
Poor	129 (75.9)
Total	170 (100)

Figure 1 - Results from both Chi-squared and Binomial tests showing difference from a pre-defined expected proportion of 50% for each primary outcome variable. Results from both tests are similar.

	Binomial Test (null hypothesis of (50% "Good" and 50% "Poor"))			**Chi-squared Test** (null hypothesis of (50% "Good" and 50% "Poor"))		
	variable	p_value	test_statistic	p_value	test_statistic	df
1	To whom pharmacists talk the most if the child accompanies a parent	3.44E-29	15	7.79E-26	110.4545455	1
2	What to do if the child did not accompany their parent	1.04E-06	51	9.36E-07	24.05454545	1
3	Understan.diff.cog.lvls	2.39E-26	147	9.90E-24	100.8545455	1
4	Understanding "cause-effect" relationship in 3−6-year-old children	2.76E-01	75	2.43E-01	1.36363636	1
5	Understanding the appropriate expression of dosage frequency to 3−6-year-old children.	8.76E-01	81	8.15E-01	0.05454545	1
6	Understanding "cause-effect" relationship in 7−12-year-old children.	3.14E-04	106	2.53E-04	13.38787879	1
7	Understanding suitable drug information provided to toddlers and pre-school children (3−5 years).	6.04E-36	10	1.25E-30	132.3529412	1
8	Understanding suitable drug information provided to school age children (6−12 years).	8.85E-35	11	7.33E-30	128.8470588	1
9	Understanding suitable drug information provided to adolescents (13−19 years).	1.21E-08	46	1.32E-08	32.2969697	1
10	Understanding suitable drug information provided to 6−19-year-old children	1.61E-01	92	1.39E-01	2.18787879	1
11	How do you generally start the conversation?	6.41E-01	79	5.86E-01	0.2969697	1
12	How do you start with a seemingly shy child?	3.50E-01	76	3.12E-01	1.02424242	1
13	Evaluating to what extent drug-drug and drug-food interactions are explained to adolescents	2.88E-27	148	2.02E-24	104.0060606	1
14	Asking parents for a few minutes alone with the child	5.34E-01	87	4.84E-01	0.49090909	1
15	Not telling parents about sensitive products bought by an adolescent	6.41E-01	79	5.86E-01	0.2969697	1
16	Methods to get the child's attention	1.02E-03	104	8.15E-04	11.20606061	1
17	Overall pharmacist performance	6.64E-10	45	8.48E-10	37.64705882	1