



# Factors influencing refusal of lumbar puncture in children under age 10: a cross-sectional study

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**Background:** This study aimed to investigate the factors associated with refusal of lumbar puncture (LP) in children aged 1–10 years who presented to a paediatric department in our hospital.

**Methods:** A sample of parents and guardians of children who presented to the paediatric department were surveyed to gather information about their educational background and decision-making processes. Attending doctors were also interviewed using a questionnaire to gather their perspectives on the reasons for LP refusal in children. Attending doctors then tried to convince the parents or guardians to see if it changed their decision.

**Results:** The study found that the majority of parents and guardians had a lower educational background, with over half being illiterate. Refusal of LP was seen most frequently in parents or guardians who were illiterate. The decision-making process was found to be heavily dependent on the father in a male-dominated society. Peer pressure and lack of knowledge were found to be factors that contributed to LP refusal.

**Conclusion:** Refusal of a LP was linked to having a lower educational background and to societal influences in this cross-sectional study of children aged 1–10 years. More than half of the parents and guardians were illiterate, indicating that they had a lower level of education. Refusing LP was influenced by a number of factors, including social pressure and a lack of information. However, these obstacles were overcome thanks to the efforts of the attending doctors who dispelled myths and reassured the parents and guardians of the necessity and safety of the procedure. Possible roadblocks include a lack of financial resources and common misconceptions about LP. These results highlight the significance of addressing educational and societal factors to enhance children's healthcare.

**Keywords:** child, health facilities, hospital, medical staff, parents, spinal puncture

## Introduction

Lumbar puncture (LP), is a vital procedure used in the diagnosis and treatment of central nervous system (CNS) infections in both children and adults. LP has been in use for over a century to diagnose and treat conditions of the CNS. It is the only way to obtain cerebrospinal fluid (CSF) without performing neurosurgery, making it a valuable tool for diagnosing meningitis, tumours, and

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## HIGHLIGHTS

- Majority of parents/guardians were illiterate and had lower educational qualifications.
- Parents/guardians felt peer pressure and looked up to other family members for advice.
- Reasons for lumbar puncture refusal included considering their child's condition not severe enough, fear of invasiveness, and fear of complications like paralysis or mental retardation.
- Attending doctors tried to convince parents/guardians by addressing their misconceptions with real-world data and assuring their experience with the procedure. Financial concerns and myths associated with lumbar puncture were common reasons for refusal from their perspective.

other issues in the nervous system. Despite some risks, LP has a good safety record when performed correctly and has few contraindications. In situations where resources are limited, LP is often the only option for diagnosing and treating neurological disorders<sup>[1]</sup>. Even with the advancements in neuroimaging and blood testing, the analysis of CSF remains crucial in diagnosing infections, tumours, and inflammation of the CNS. The use of liquid biopsy and the development of CSF biomarkers for neurodegenerative diseases, neuroinflammatory disease, and CNS malignancies have increased the clinical indications for LP. Several

neurologic diseases have guidelines that support the use of CSF analysis. LP can also be used therapeutically to remove excess CSF and temporarily relieve symptoms, or for administering certain medications directly into the spinal sac. Despite the benefits of LP, many patients fear it and believe it to be a long and painful procedure, but it is usually well tolerated. This discrepancy in perception has led to hesitation in performing LP in clinical practice and research<sup>[2]</sup>.

In both children and adults, a LP is a crucial procedure for the diagnosis and treatment of infections of the CNS. The use of LP to diagnose meningitis, tumours, and other CNS problems has persisted for over a century. It is a helpful diagnostic tool because it eliminates the need for invasive brain surgery to collect CSF. When carried out properly, LP has a solid safety record and very few contraindications<sup>[2]</sup>. To diagnose and treat neurological disorders, LP is often the only option in settings with limited resources. CSF analysis is still important for identifying infections, tumours, and CNS inflammation despite developments in neuroimaging and blood testing. Therapeutic uses of LP include aspiration of CSF and injection of drugs into the spinal canal. LP is generally well tolerated, despite the fact that some patients have worries and misconceptions about it<sup>[3]</sup>.

Religious and cultural beliefs can play a role in the refusal of medical procedures such as LP, which is commonly performed in children. Studies have shown that the rate of refusal for LP can vary greatly across different countries, with rates as high as 80% in Kuwait, 62% in Iran, 44% in the UAE, 24.7% in Malaysia, and 7% in Denmark, narrowing down to 5% in the United States<sup>[4]</sup>. Research has been conducted to understand the reasons behind the refusal of LP. One study in the UAE found that 43% of families refused due to fear of complications, and 11% thought the procedure was unnecessary<sup>[5]</sup>. Another study in Iran revealed that 67% of families refused because they feared paralysis and backache<sup>[3]</sup>. Studies have also shown that certain ethnicities and levels of education may be associated with higher refusal rates.

A study by Ahmad *et al.*<sup>[6]</sup> found that the main reasons for parental refusal for LP in children were fear of limb paralysis and fear of death<sup>[6]</sup>. LP is particularly important in young children, as it can detect meningitis, which may not have obvious symptoms<sup>[3]</sup>. In situations where LP is refused, there can be negative consequences, such as prolonged hospital stays, increased risk of nosocomial infections, and delayed diagnosis and treatment. In resource-limited settings, failure to perform LP can result in higher morbidity and mortality rates<sup>[7]</sup>. A study by Narchi *et al.*<sup>[8]</sup> found that awareness of the potential complications of meningitis was a significant factor in parents consenting to the procedure<sup>[8]</sup>. Refusal to LP can also lead to longer antibiotic treatment, longer hospital stays, and patients leaving against medical advice, which can add to the burden on the healthcare system<sup>[9]</sup>.

The refusal to undergo a LP can lead to the use of antibiotics without a proper diagnosis, increasing the risk of antibiotic resistance and prolonging hospital stays. Additionally, this may result in the failure of administering prophylactic antibiotic therapy for contact bacterial meningitis<sup>[8]</sup>.

Apart from a single study<sup>[6]</sup>, there is a general lack of data on the frequency and risk factors for LP refusal in Pakistan, so the authors of this study aim to investigate these factors.

Complications associated with the LP procedure can vary in frequency and severity. It is crucial to provide an overview of the most frequent complications supported by data on their

occurrence to understand the underlying reasons for LP refusal. While the current abstract does not explicitly mention specific complications, it highlights the need to address misconceptions and fear associated with the procedure. To provide more specific information, we can add a sentence highlighting the potential complications of LP and their relevance to the study<sup>[8]</sup>. LP, although generally safe, can have potential complications, such as post-procedure headache, back pain, local bleeding, infection, and very rarely, nerve damage. Understanding the frequency and significance of these complications is important in assessing the reasons for LP refusal and implementing strategies to address misconceptions and alleviate concerns<sup>[9]</sup>.

By including this information, readers will have a clearer understanding of the potential complications and their relevance to the study's focus on addressing LP refusal in children.

However, despite the benefits and safety record of LP, there are instances where patients, particularly children, may refuse to undergo the procedure. Understanding the reasons behind the refusal of LP is essential to address any misconceptions and improve healthcare for children. Previous studies have reported variations in the refusal rates for LP across different countries, highlighting the influence of cultural beliefs and knowledge gaps. In some cases, religious and cultural beliefs, as well as fear of complications, paralysis, or death, have been identified as factors contributing to LP refusal. However, it is important to gather data on the frequency and risk factors for LP refusal in specific regions, such as Pakistan, to develop targeted interventions and improve healthcare outcomes.

The novelty of the present study lies in its focus on the frequency and risk factors for LP refusal specifically in Pakistan, which is a country that lacks sufficient data on this topic. While studies conducted in other countries have shed light on the influence of social and cultural factors on LP refusal, there is a notable knowledge gap regarding the situation in Pakistan. By conducting this cross-sectional study in Pakistan, the authors aim to fill this gap and provide valuable insights into the factors contributing to LP refusal among children under the age of 10 in this specific cultural context.

Understanding the specific factors that lead to LP refusal in Pakistan is crucial for developing targeted interventions and strategies to address this issue. By identifying the reasons behind the rejection of LP and exploring potential risk factors, healthcare professionals can better tailor their communication and counselling approaches to alleviate parental fears and misconceptions. This study has the potential to contribute to the existing literature on LP refusal, providing a more comprehensive understanding of the cultural and social dynamics at play in Pakistan, and potentially offering insights that can be generalized to similar contexts.

## Methodology

In the present study, we aimed to explore the reasons for refusal of LP by including data from parents and guardians of children aged 1 month–10 years. The study adopted a cross-sectional design to investigate the factors associated with the refusal of LP in children aged 1–10 years old. LP is a common diagnostic procedure that is performed to collect CSF for analysis, which can provide important information about the patient's neurological condition. However, some parents and guardians may refuse to consent to this procedure for their child due to various reasons.

To investigate this phenomenon, we utilized a pre-validated questionnaire for our region<sup>[6,9,10]</sup> as our research instrument. The sample size of 100 respondents was obtained through convenient sampling. The sample was chosen from parents or guardians of children who were referred for LP by the paediatric department of our hospital. The questionnaire was designed to collect information about the respondent's highest attained educational qualifications, which were categorized as illiterate, middle pass, matric pass, intermediate pass, and graduates. Illiterate was defined as parents/guardians who did not attend any form of schooling, middle pass was defined as parents/guardians whose highest attained education was class VII, matric pass was defined as parents/guardians whose highest attained educational qualification was high school, intermediate pass was defined as those parents/guardians whose highest attained educational qualification was higher secondary school and graduates were defined as parents/guardians whose highest attained educational qualification was a bachelors degree. This information was collected to determine whether there was any association between the parents/guardians' educational level and their decision to refuse LP for their child. Additionally, the questionnaire inquired about the following:

- History of fits in the family: We wanted to know whether the parents/guardians had a history of fits or seizures in their family, as this information could influence their decision to refuse LP for their child.
- History of LP in other family members: We wanted to know whether any other family members had undergone LP in the past and if so, whether this experience had any impact on the parents/guardians' decision to refuse LP for their child.
- History of death of any siblings with similar complaints: We wanted to know whether the parents/guardians had any siblings who had died due to similar complaints as the child for whom LP was being requested, and if so, whether this had any impact on their decision to refuse LP for their child.
- History of death of a child in the family after LP: We wanted to know whether the parents/guardians had any experience of a child in their family dying after undergoing LP, and if so, whether this had any impact on their decision to refuse LP for their child.
- People who majorly influenced decision-making in LP refusal by parents/guardians (father, mother, and guardian, extended family member other than father, mother or guardian): We wanted to know who played the major role in the decision-making process of refusing LP for their child.
- The questionnaire included open-ended questions to elicit reasons for LP refusal, categorized into five main categories: invasive procedure, fatal procedure, caused paralysis, caused intellectual disability, and the child didn't need it.

They were asked about various contributing factors like fear of side effects, little knowledge of the disease, unsuccessful experience and lack of medical facility. Whereas the presence of chronic cardiovascular or respiratory conditions like congenital heart disease, lung cyst, etc, structural defects like meningomyelocele, encephalocele and base of skull fracture, immunocompromised or having recurrent meningitis, hemodynamically unstable, signs of raised ICP, deranged coagulation profile and thrombocytopenia, infection at LP site and known case of febrile fits were excluded from the study. Open-ended questions were also included to elicit reasons for LP refusal, which were subdivided into five main categories: invasive procedure, fatal procedure,

caused paralysis, caused intellectual disability, the child did not need it. This information was collected to understand the various reasons why parents/guardians refused LP for their child.

The attending doctors were also asked about their experience in performing LP procedures and data were collected regarding the frequency of successful LP procedures they had performed, which were divided into three categories: done procedure once, two to five times, more than five times. This information was collected and reported in frequencies. Furthermore, data was acquired regarding the socioeconomic status of parents/guardians using interviews. Regarding data analysis, sex, education status of parents and was presented as frequencies. Age as mean and standard deviation. Chi square test was applied. *P* value of less than or equal to 0.05 was considered significant. Data was stratified for age, sex, education of parents. Attending doctors were also asked if they tried to convince the parents or guardians as well as explained the procedure to them including suggestions of alternative investigations to see if it changed their decision to accept LP. Detailed questionnaire can be found in the supplementary file to this paper, Supplemental Digital Content 1, <http://links.lww.com/MS9/A263>. This study was conducted in accordance with the Declaration of Helsinki and the guidelines of the International Council for Harmonization. STROCCS<sup>[11]</sup> guidelines were followed and a STROCCS checklist is provided as a supplementary file, Supplemental Digital Content 1, <http://links.lww.com/MS9/A263>. Descriptive statistical analysis was performed using IBM SPSS Statistics for Windows, Version 23.0 software.

## Results

In this study, a total of 100 parents or guardians of children aged 1–10 years were surveyed. The majority of parents or guardians (over 50%) were illiterate, indicating a lower educational background. The distribution of educational levels among the parents or guardians is as follows:

Results related to demographic characteristics in numerical and percentage form:

- Illiterate: 55%
- Middle pass: 15%
- Matric pass: 20%
- Intermediate pass: 5%
- Graduates: 5%

The attending doctors who were interviewed had experience performing LP procedures. The distribution of their experience in LP procedures is as follows:

- Results related to physicians:
- Done the procedure once: 15%
- Done the procedure two to five times: 18%
- Done the procedure more than five times: 67%

Most of the parents or guardians were illiterate as shown in Fig. 1.

Out of the four questions, majority of the respondents reported of having history of fits in the family that has caused them to fearful of LP as shown in detail in Table 1.

Refusal of LP procedure was reportedly a collective decision of both parents or guardians most of the time. Only 11% of refusal was done by mothers or female guardians. A significant number of refusals were due to the advice of family member other than parents as shown in detail in Fig. 2.

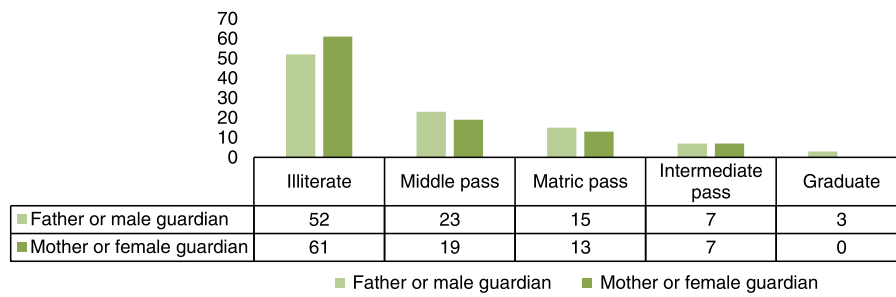


Figure 1. Educational level of parents or guardians.

Data regarding reasons for LP refusal revealed that majority of the parents or guardians responded that they felt the procedure was unnecessary for the child. Twenty percent of the refusals were the result of parents or guardians considering it an invasive procedure and did not want their child to pass through the ordeal. There were other reasons as well as shown in Fig. 3.

A multivariate logistic regression analysis was performed to identify significant factors associated with LP refusal as shown in Table 2. Table 2 displayed the outcomes of a multivariable logistic regression analysis aimed at investigating risk factors associated with the refusal to undergo a LP. This study involved 100 participants, and several factors were examined, including “Poor counselling,” “Family pressure,” “Myths,” and “Low socioeconomic status,” each with corresponding regression coefficients (B) of 1.04, 1.46, 3.76, and 1.80, respectively. The odds ratios (OR) with 95% CI are also provided for each factor, representing the likelihood of LP refusal when a specific factor was present versus absent. An odds ratio greater than 1 indicated an increased risk, while less than 1 suggested a reduced risk. The analysis revealed statistically significant associations between “Poor counselling,” “Family pressure,” and “Myths” and an elevated risk of refusing LP, as evidenced by their respective *P* values of 0.012, 0.023, and 0.001. However, “Low socioeconomic status” was associated with a slightly increased risk, with a *P* value of 0.049, suggesting a less robust relationship. In conclusion, these findings underscore the importance of addressing poor counselling, family pressure, and myths in medical settings to improve patient acceptance and compliance with essential procedures like LP. Healthcare professionals should consider these risk factors and employ targeted interventions to mitigate refusal rates effectively, though further research may be necessary to comprehend the precise mechanisms involved in influencing patients’ decisions.

After investigating the causes of refusal, the respondents were asked about any actual patient that they know has any of the side effect of LP. Only one parent/guardian sited that they actually

know a family member that went through LP and it caused paralysis as a result. Ninety-nine percent of parents/guardians have taken their decisions by developing their minds listening to other instances that they can’t actualize. The attending doctors had performed the procedure before so they had proper knowledge and practical experience of doing the procedure safely. Majority of doctors (67%) had performed the procedure more than five times as shown in Fig. 4 and had a greater understanding of LP procedure, its consequences and complications.

Attending doctors explained the procedure as well as the consequences that may occur if procedure is not done to all parents or guardians including assent from children. At least one try was made to convince the parents if they refused the procedure on the initial try. Only half of the attending doctors performed a fundoscopy before performing a LP. Myths and financial reasons were the leading causes of refusal according to attending doctors. Details on other reasons can be found in Fig. 5.

There were 15 attending doctors who took part in this study. The hospital where this study was carried out is a tertiary care hospital with paediatric expertise. The attending doctors explained the LP procedure and its consequences to the parents or guardians, including the potential complications that may arise if the procedure is not performed. They also tried to convince the parents or guardians to undergo the procedure, addressing misconceptions and providing assurance of its safety and necessity. Financial constraints and myths associated with LP were identified as potential barriers to the procedure, as mentioned by the attending doctors.

**Table 1**  
Number of respondents who responded to questions about history of aforementioned complaints.

Questions	No. respondents (N= 100)
History of fits in family	57
History of lumbar puncture in other family members	41
History of death of any siblings with similar complaint	0
History of death of child in family after lumbar puncture	2

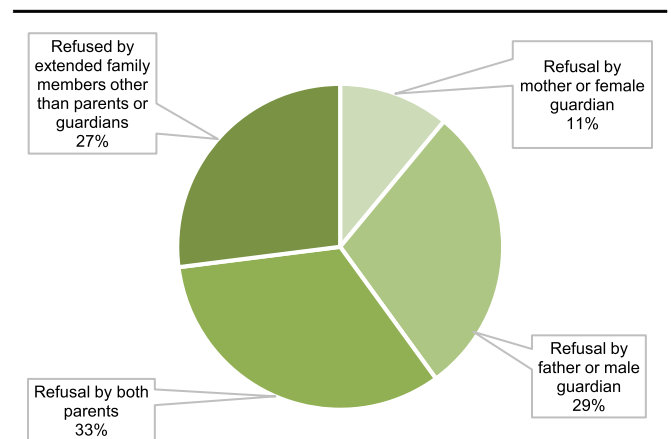


Figure 2. Refusal of lumbar puncture.

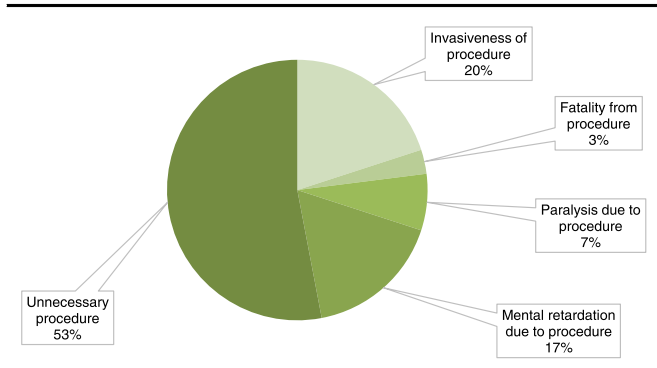


Figure 3. Reasons for refusal of lumbar puncture.

**Discussion**

Upon analysis of the results of our study of parents and guardians of children aged 1–10 years that presented to the paediatric department of our hospital, we found out that most of the parents or guardians of the children that presented to our department were illiterate so the study mostly deals with the parents or guardians of lower educational background. To be more precise, more than half of all male and female parents of guardians were illiterate. Almost 70% of fathers and 80% of the mothers had secondary school as their highest educational qualification and less than 10% of parents or guardians had attained graduate level education, hence it can be said that a lower educational qualification of parents or guardians is associated with refusal of LP in children. The history of families with complications due to LP is important to understand their decision-making process and to ascertain the factors involved in shaping their decision towards its acceptance or rejection. The refusal of LP procedure was generally a collective decision of both parents or guardians. In a male-dominated society, generally the major decision-making is heavily dependent on the father of the family<sup>[12]</sup>. From our analysis, we also found the same pattern of decision-making for consent of interventions performed on children.

One of the most surprising factors we found was that parents or guardians had a significant amount of peer pressure and influence to refuse a procedure such as LP for children and this contributed significantly towards the LP refusal. Parents or guardians usually considered themselves to be incapable of making the decision to either accept or reject the procedure for their children and looked up to some other family member for advice.

Upon further investigation when parents or guardians were asked about the reasons of LP refusal, we received surprising

**Table 2**  
Multivariable logistic regression analysis showing risk factors for refusal to lumbar puncture (n = 100)

Factor	B	OR with 95% CI	P	$\chi^2$
Poor counselling	1.04	2.2 (2.0–2.4)	0.012	5.7
Family pressure	1.46	3.6 (3.2–3.8)	0.023	19.2
Myths	3.76	4.9 (4.7–5.1)	0.001	17.9
Low socioeconomic status	1.80	2.1 (1.9–2.4)	0.049	4.4

B, slope; OR, odds ratio; P, p value of odds ratio.

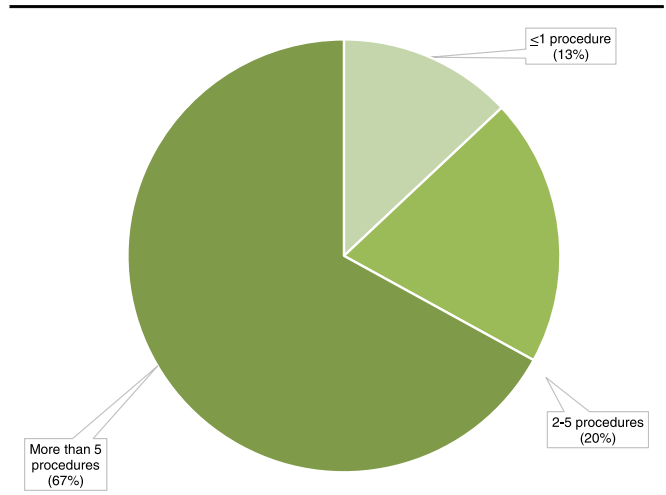


Figure 4. Number of lumbar puncture procedures in past.

answers. Majority of the parents or guardian felt that their child’s condition was not so severe to warrant an LP procedure.

Among other reasons mentioned for LP refusal were the relative invasiveness of the procedure which prompted them to deny consent for the procedure. They felt that the unnecessary procedure was a painful ordeal on their children. Fear of invasive procedures including injections have also been reported by Aldayel *et al.*<sup>[10]</sup>. Less than 10% of parents or guardians thought that by an LP could cause intellectual disability and paralysis of their children and they wanted to avoid this risk by denying the procedure for their children. This is in agreement to the findings of Acoglu *et al.*<sup>[13]</sup> from Turkey<sup>[13]</sup>. A recent study from Pakistan also reported that fear of complications from the procedure was one of the main reasons that prompted parents to refuse the procedure for their children<sup>[9]</sup>. A minority of parents or guardians considered LP as a fatal procedure and refused to proceed due to the supposed outcome of the procedure. After investigation of the reasons for refusal of LP, parents or guardians were asked about any actual patient that they knew had any of the side effect of LP they mentioned. Only one parent reported that they actually knew a family member that went through LP and it caused paralysis as a result. 99% of parents/guardians had taken their decisions by developing their minds listening to others without

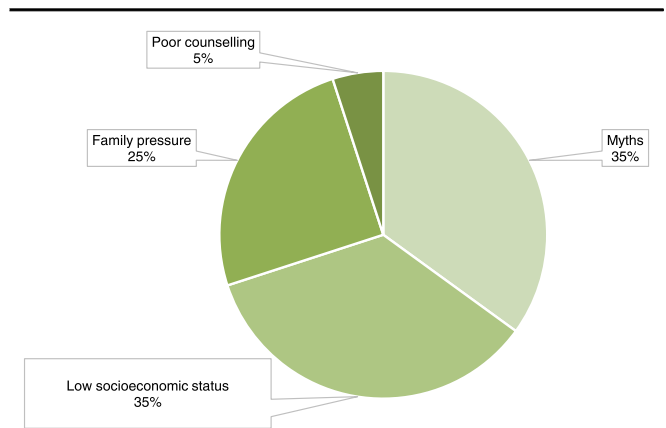


Figure 5. Reasons of lumbar puncture refusal according to attending doctors.

any empiric evidence. Similar lack of knowledge has also been observed by Aldayel *et al.*<sup>[10]</sup> from a study in Saudi Arabia<sup>[10]</sup>. Our study is in agreement with a study conducted by Ahmad *et al.*<sup>[6]</sup> involving 215 individuals who were recommended for LP. It was reported that 32.6% of their families declined the procedure for their children. The main reason cited for this refusal was fear of limb paralysis, which was reported in 64.2% of the cases. Additionally, 31.3% of the parents expressed fear of death as a reason for declining LP. In some instances, 19.4% of the parents believed that the procedure was unnecessary<sup>[6]</sup>. Other studies also report almost similar results<sup>[6]</sup>.

The attending doctors were also questioned to understand their perspective on LP refusal. After initial refusal, attending doctors tried to convince parents or guardians by addressing their misconceptions with real-world data. Convincing attendants comprised of explaining the procedure and the consequences of LP refusal on child's health. The attending doctors also assured the parents or guardians that they had ample experience of doing the procedure safely before embarking upon the procedure. After much convincing, the attending doctors were able to convince all parents or guardians and proceeded to perform the procedure on children. Although our study was not an interventional trial but a study by Witbracht *et al.*<sup>[14]</sup> conducted a randomized controlled trial on a similar topic and found that education about the lesser probability of experiencing adverse events before the procedure could lead to positive outcomes and increased patient participation. Although their study specifically studied whether this influenced willingness to participate in research regarding LP, but it is not far from imagination to see similar results in the clinical arena<sup>[14]</sup>. From the perspective of attending doctors, the main reasons that could be associated with LP refusal was the financial condition of the family. They thought that parents or guardians were generally concerned that the financial restraints of the invasive procedure and they would probably not be able to afford such a procedure for their children. This thought mainly stemmed from the fact that families in the respondent pool were generally not from well-off strata of the society. As the data was collected from a public hospital which caters to the needs of masses, the majority of patients it caters come from middle or lower middle class of the society. It is understandable that they would consider their financial constraints before indulging into anything that could further stretch their financial resources. The second most common reason from the attending doctor perspective were the myths associated with LP. The majority of parents or guardians were staunch believers of local myths associated with the procedure such as intellectual disability and paralysis among others. Even if the parents or guardians didn't experience the side effects themselves or in someone they knew in their close family, they still had this belief held it higher than doctor's counselling, at least before the doctors made the first attempt to convince them of the safety and necessity of the procedure for their acutely sick children.

### Limitations of the study

The limitations of this study include its small sample size, focus on a specific population (parents or guardians of children aged 1–10 attending a public hospital), and that the majority of participants had a lower level of education. Another limitation of this study is that it only looks at parents or guardians who refused LP, not those who consented. This means that the study is only able to

provide information on the factors that lead to the refusal of LP, not the factors that lead to its acceptance. Furthermore, the study did not explore the reasons why the attending doctors were able to convince all the parents or guardians to proceed with the LP procedure. In addition, the study was conducted in a tertiary care hospital and it is not known how well the findings generalize to other settings or populations. Finally, the study did not investigate the potential long-term impact of LP refusal on the children's health, such as delayed diagnosis or treatment in this specific stratum of patients of this region.

### Guidance for further research

Further research should focus on expanding the sample size to include a more diverse population, as well as conducting a longitudinal study to understand the decision-making process and factors involved in the refusal of LP procedures over time. It should also investigate the impact of education, especially the mothers as reported by Alshaibari *et al.*<sup>[11]</sup> and financial status on decision-making, as well as addressing the misconceptions and myths surrounding LP. It should also investigate the factors that influence the acceptance of LP, as well as the strategies used by attending doctors to overcome refusal. Research should also be conducted in different settings and populations to determine the generalizability of the findings.

### Conclusion

The findings of this cross-sectional study provide valuable insights into the factors associated with the refusal of LP in children aged 1–10 years. The study revealed that the majority of parents and guardians had a lower educational background, with over half being illiterate. This finding suggests that a lower educational background may contribute to a lack of understanding and knowledge about the importance and safety of the LP procedure. The decision-making process was found to be heavily dependent on the father in a male-dominated society. This finding highlights the need to involve both parents in the decision-making process and provide them with accurate information and counselling about the benefits and necessity of LP. Peer pressure and lack of knowledge were identified as factors that contributed to LP refusal. These findings emphasize the importance of community education and awareness programs to address misconceptions and provide accurate information about LP. By addressing these factors, healthcare providers can help alleviate fears and improve acceptance rates of the procedure. Attending doctors were able to overcome barriers to LP refusal by addressing misconceptions and assuring parents and guardians of the safety and necessity of the procedure.

### Ethics approval and consent to participate

Written informed consent was taken from all participants of the study. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval was granted by ethical review committee of Maroof International Hospital under reference no: ERC/MI/22/019 on Monday 8 August 2022.

**Consent to publish**

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**Author contributions**

S.M.: study design, data collection and statistical analysis. R.F. and A.N.: study design and data collection. M.S.: study design, data analysis and conceptualization. A.K. and I.S.: data collection and management. S.M.: data analysis and interpretation of the results. H.M.: supervision and interpretation of the results. All authors contributed to the writing and revision of the manuscript and approved the final version for submission.

**Conflicts of interest disclosure**

Not applicable.

**Research registration unique identifying number (UIN)**

The study is registered in Open Science Framework database and can be accessed from: <https://doi.org/10.17605/OSF.IO/ZJF5K>.

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**Availability of data and materials**

Deidentified data will be made readily available upon reasonable request to the corresponding author.

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**References**

- [1] Alshaibari KS, Hasan ER, Dammaj MZ, *et al.* Mothers' views about lumbar puncture for their children in a Maternity and Children's Hospital in Najran, Saudi Arabia. *Pediatr Health Med Ther* 2021;12:91–9.
- [2] Umemura Y, Khan B, Weill BJ, *et al.* Discordance between perceptions and experience of lumbar puncture: a prospective study. *Neurol Clin Pract* 2022;12:344–51.
- [3] Sharif MR, Alizargar J, Sharif AJM-EJSR. Rate of parental consent to lumbar puncture for diagnosis of febrile convulsion 2014;21:427–30.
- [4] Farag E, Husain EH, Fathy H, Shawky AJKMJ. Perceptions and attitudes towards lumbar puncture (LP) among parents in Kuwait 2009;41:306–9.
- [5] Narchi H, Ghatasheh G, Al Hassani N, *et al.* Why do some parents refuse consent for lumbar puncture on their child? A qualitative study. *Hospital Pediatr* 2012;2:93–8.
- [6] Ahmed M, Ejaz M, Jahangeer A, *et al.* Frequency and associated factors of parental refusal to perform lumbar puncture in children with suspected central nervous system infection: a cross-sectional study. *Cureus* 2019;11: e5653.
- [7] Thakur KT, Mateyo K, Hachaambwa L, *et al.* Lumbar puncture refusal in sub-Saharan Africa: a call for further understanding and intervention. *Neurology* 2015;84:1988–90.
- [8] Narchi H, Ghatasheh G, Hassani NA, *et al.* Comparison of underlying factors behind parental refusal or consent for lumbar puncture. *World J Pediatr* 2013;9:336–41.
- [9] Ahmed M, Ejaz M, Nasir S, *et al.* Parental refusal to lumbar puncture: effects on treatment, hospital stay and leave against medical advice. *Cureus* 2020;12:e7781.
- [10] Aldayel AY, Alharbi MM, Almasri MS, *et al.* Public knowledge and attitude toward lumbar puncture among adults in Riyadh, Saudi Arabia: a cross-sectional study. *SAGE Open Med* 2019;7:2050312119871066.
- [11] Mathew G, Agha R. for the STROCCS Group. STROCCS 2021: Strengthening the Reporting of cohort, cross-sectional and case-control studies in Surgery. *Int J Surg* 2021;96:106165.
- [12] Coltrane S. Father-child relationships and the status of women: a cross-cultural study. *Am J Sociol* 1988;93:1060–95.
- [13] Acoglu EA, Oguz MM, Sari E, *et al.* Parental attitudes and knowledge about lumbar puncture in children. *Pediatr Emerg Care* 2021;37:e380–3.
- [14] Witbracht MG, Bernstein OM, Lin V, *et al.* Education and message framing increase willingness to undergo research lumbar puncture: a randomized controlled trial. *Front Med* 2020;7:493.