Am. J. Trop. Med. Hyg., 104(5), 2021, pp. 1925–1931
doi:10.4269/ajtmh.20-0509

Lumbar Puncture-Related Knowledge, Attitudes, and Practices among Patients, Caregivers, Doctors, and Nurses in Zambia

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Abstract. Lumbar puncture (LP) is underused for neuroinfectious disease diagnosis in Zambia, but reasons for poor uptake remain speculative. This cross-sectional study assessed LP knowledge, attitudes, and practices among patients/caregivers and healthcare workers (HCWs) and predictors of LP completion. Patients with suspected central nervous system infection, caregivers, and HCWs at the University Teaching Hospitals in 2016 were eligible. Questions adapted from the existing literature were used for a LP knowledge score. Predictors of knowledge scores were assessed independently for patients/caregivers and HCWs. Predictors of LP completion were assessed using multivariable logistic regression. Among 123 patients/caregivers, LP knowledge was poor. Pediatric caregivers were more likely than adult patients/caregivers to report LP could be replaced by neuroimaging (90% versus 78%, $P < 0.001$) and cause paralysis (57% versus 39%, $P = 0.01$). There were no significant predictors of the knowledge score among patients/caregivers. Among HCWs, 28% said LP makes patients clinically worse, and 60% reported it could cause paralysis. The increased knowledge score was associated with greater wealth ($P = 0.03$) and personally knowing someone who underwent LP ($P < 0.001$). Lumbar puncture was completed on 67/112 (57%) patients and was associated with an increased knowledge score (OR: 1.62 [95% CI: 1.19–2.23]). Pediatric patients (OR: 0.18 [95% CI: 0.07–0.47]) and those with a fear of paralysis (OR 0.29 [95% CI: 0.11–0.77]) were less likely to undergo LP. Improving LP-related knowledge may improve uptake. Healthcare workers sense of LP risk may also play a role in encouraging/discouraging use.

INTRODUCTION

Cerebrospinal fluid (CSF) analysis plays an integral role in the diagnosis of neuroinfectious diseases, yet lumbar puncture (LP) is often not performed in sub-Saharan African and other resource-limited settings.[1,2] In 2011, 40% of HIV-positive Zambian adults with new-onset seizures did not undergo LP.[3] Similar findings were reported among Zambian children suspected to have meningitis or encephalitis.[4] The reasons for poor LP uptake in Zambia and other regions remain poorly defined. Prior studies examining LP uptake are often limited to surveys of healthy adults[5,6] or relatives of children with febrile seizures.[7] In these studies, fear of pain, paralysis, and death were common among individuals who refused or indicated they would likely refuse an LP.[8–10] Although fear of pain or poor outcomes may not be entirely unfounded,[9] a heightened sense of risk about LP may be exacerbated by a lack of knowledge about the procedure and potential benefits.[6,8] In addition, healthcare workers (HCWs) are an important source of information to patients and their families, especially during the consent process, but there are little data regarding HCW knowledge and practices related to LP utility and completion. Understanding both patient and HCW perspectives related to LP uptake is crucial to overcoming barriers to performance of this essential neurodiagnostic procedure. To better characterize predictors of LP uptake, we examined LP-related knowledge, attitudes, and practices among Zambian patients with suspected CNS infection, their caregivers, and HCWs.

MATERIALS AND METHODS

Patients and caregivers. Participants were recruited between April 4, 2016 and July 19, 2016 from the University of Zambia's University Teaching Hospitals Adult and Children's Hospitals in Lusaka, Zambia. Eligible patients were adults and children presenting with symptoms suggestive of CNS infection such as but not limited to meningitis and encephalitis. If the patient was either younger than 18 years or was unable to make decisions related to his/her care because of poor mental status, a proxy decision-maker (i.e., caregiver) at bedside was approached for study participation. Patients were identified by nurses going bed to bed in the adult and pediatric emergency, admission, and medical wards. Study staff were not involved in the care of patients eligible for participation. If written consent was obtained (see ethics in the following text), participants were interviewed in a private room attached to the ward. At the end of each interview, participants were provided 30 Kwacha (~6 USD) to assist with transportation costs.

Instruments. Participant demographics, including education and area of residence, were collected via structured interviews. Household wealth was used as a proxy for socioeconomic status by enumerating the value of common household goods.[11] Clinical information regarding the patient's presenting illness, comorbid illnesses including HIV infection, functional status before presentation using the Karnofsky score (adults) or Lansky score (pediatrics), and admitting diagnosis was also collected. If a caregiver was interviewed in lieu of the patient, their relationship to the patient was ascertained.

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Lumbar puncture-related knowledge and attitudes were assessed using a series of multiple-choice questions that were selected after a thorough review of the literature and consulting experts in the region. Questions were tailored to fit indications for LP for our clinical setting, which includes headache from high intracranial pressure due to cryptococcal meningitis. All participants were asked whether they had heard of the procedure and to rate how much they knew about it. Sources of LP-related information, including prior experience with the procedure, were collected. Participants were then given a list of statements about the purpose, risks, and benefits of LP and asked to indicate whether they agreed or disagreed. Lumbar puncture-related practices were also determined by assessing the likelihood of consent to an LP for themselves or a relative, if requested by a doctor. Data were collected regarding whether an LP was recommended during the current admission and whether it was performed. Dates of initial LP recommendation and completion were abstracted from the patient's chart.

Doctors and nurses. Healthcare workers were interviewed between April 14, 2016 and July 21, 2016. Eligible HCWs included physicians and nurses older than 18 years providing care to a patient with suspected CNS infection. As the University Teaching Hospitals Adult and Children's Hospitals are separate institutions, there was no overlap in HCWs between the adult and children's wards. Eligible nurses were interviewed by a trained study nurse, whereas doctors were interviewed by a visiting physician (CB). All HCWs were interviewed in a private ward auxiliary room or the study office and were provided 30 Kwacha (~6 USD) at the end of the interview.

Instruments. Participant demographics and household wealth were collected for all providers via a structured interview. Clinical role and duration of employment at the University Teaching Hospitals were ascertained. Lumbar puncture-related knowledge, attitudes, and practices were also assessed. All HCWs were asked if they knew someone who had undergone an LP who was not a patient under their care. They were asked about sources of LP-related knowledge in addition to their formal medical training. Healthcare workers were given the same list of statements about the purpose, risks, and benefits of LP as patients and caregivers, and were asked to indicate whether they agreed or disagreed. Lumbar puncture practices were assessed by HCW likelihood to agree to an LP on themselves or a relative if requested by a doctor.

Standard protocol approvals, registrations, and patient consents. Written, informed consent was obtained from all study participants in English or a local language (Nyanja or Bemba). Ethical approval for this study was obtained from the University of Zambia's Biomedical Research Ethics Committee and the Michigan State University Biomedical Institutional Review Board.

Statistical analysis. *Lumbar puncture knowledge score.* An LP knowledge score was calculated for all patients, caregivers, doctors, and nurses using dichotomous responses to questions regarding the utility, benefits, and risks of LP. Included items are provided in Table 1. For this score, unsure responses were considered incorrect.

Patients and caregivers. Patients and caregivers were grouped by the age of the patient (adult versus pediatric). Group frequencies and means for demographic and patient clinical characteristics were compared between the adult and pediatric groups using two-way *t*-tests or χ^2 tests, as appropriate. Responses to knowledge and attitudes questions were also compared between groups. Predictors of patient/caregiver knowledge scores were assessed using *t*-tests, analysis of variance (ANOVA), and Pearson's correlation coefficients (*r*).

For patients who had an LP requested as part of their workup, McNemar's test was used to assess agreement between likelihood of agreeing to an LP on themselves or a relative, as appropriate, and consent to an LP this hospital admission. For this analysis, unsure responses to the former question were grouped with likely refusals. Predictors of LP completion this admission were assessed using multivariable logistic regression. Effect modification was assessed using interaction terms.

Doctors and nurses. Healthcare workers were grouped based on the clinical role (doctor versus nurse), and differences in baseline demographics, LP knowledge, attitudes, and practices were assessed using the appropriate tests. Lumbar puncture knowledge scores were compared between doctors and nurses, and predictors of the increased knowledge score were assessed using *t*-tests, ANOVA, and Pearson's correlation coefficients. McNemar's test was used to assess agreement between HCW likelihood to agree to an LP on themselves versus on a relative.

SAS software was used for all analysis (version 9.4, SAS Institute Inc., Cary, NC), and a *P*-value less than 0.05 was considered statistically significant. Assuming an LP uptake

TABLE 1
Items included in LP knowledge score

Item	Correct (1 point)	Incorrect (0 point)
LP should be recommended for all patients with meningitis.	Yes	No Unsure
LP can be replaced with a blood test.	No	Yes Unsure
LP can be replaced with a CT or MRI scan.	No	Yes Unsure
LP can be performed in adults and children.	Yes	No Unsure
LP can lead to infertility.	No	Yes Unsure
LP is a safe investigation when performed properly.	Yes	No Unsure
LP is not necessary to make a diagnosis of meningitis.	No	Yes Unsure

LP = lumbar puncture.

percentage of 70%, with a sample size of 120 patients, we will have > 80% power to detect a 30% difference in dichotomous beliefs.

RESULTS

Patients and caregivers. Sixty-three pediatric caregivers and 60 adult patients/caregivers were interviewed. One adult patient declined interview because of strongly held beliefs about the risks of LP; 60% (36/60) of adult patients/caregivers were bedside caregivers. A greater percentage of pediatric caregivers were female than adult patients/caregivers (83% versus 62%, $P = 0.02$, Table 2). This was because most bedside caregivers in the Children's Hospital are the patients' mother.

Although most patients and caregivers had heard of LP, 75% (45/60) of adult patients/caregivers and 80% (48/63) of pediatric caregivers indicated that they knew little about the procedure; 65% (80/123) knew someone who had undergone an LP (Table 2). Pediatric caregivers were more likely than adult patients/caregivers to cite doctors and nurses as sources of LP-related knowledge (doctors: 83% of pediatric caregivers versus 58% of adult patients/caregivers, $P < 0.001$; nurses: 35% of pediatric caregivers versus 25% of adult patients/caregivers, $P = 0.02$), whereas adult patients/caregivers were more likely to report discussing LP with other hospital staff, such as orderlies and clerks (23% of adult patients/caregivers versus 10% of pediatric caregivers, $P = 0.04$); 54% (67/123) of all interviewed patients/caregivers reported that family

TABLE 2
Patient and caregiver demographics, LP knowledge, attitudes, and practices

	Adults (n = 60)	Pediatrics (n = 63)	P-value
Demographics			
Female gender, *n* (%)	37 (62)	52 (83)	**0.02**
Mean age (SD) years	36.6 (12.4)	35.7 (12.6)	0.39
Marital status, *n* (%)			
Married	43 (72)	45 (72)	0.38
Divorced	7 (12)	13 (21)	
Never married	9 (15)	5 (8)	
Household size			
Mean adults (SD)	3.1 (1.8)	3.1 (1.3)	0.99
Mean children (SD)	2.5 (2.1)	2.7 (1.4)	0.53
Education, *n* (%)			
Primary	16 (27)	23 (37)	0.11
Secondary	40 (67)	29 (46)	
Advanced	1 (2)	4 (6)	
None	3 (4)	7 (11)	
Mean wealth USD (SD)	1,979 (2,722)	1,572 (3,034)	0.44
High-density housing n, (%) (n = 116)	33 (56)	36 (62)	0.78
Knowledge, *n* (%)			
Heard of LP	54 (90)	60 (95)	0.32
Personal experience with LP	41 (68)	39 (62)	0.46
LP should be recommended for the following:			
Patients with meningitis	41 (68)	46 (73)	0.36
Adults and children	49 (82)	5 (87)	0.16
LP can be replaced by the following*			
A blood test	45 (75)	51 (81)	0.16
A CT or MRI scan	47 (78)	57 (90)	**< 0.001**
Attitudes, *n* (%)			
Risks†			
Painful	54 (90)	62 (99)	0.07
Cause infertility	16 (27)	25 (40)	0.21
Cause paralysis	23 (39)	36 (57)	**0.01**
Lead to death	27 (45)	34 (54)	0.50
Make people worse	26 (43)	42 (67)	**0.01**
Benefits†			
Shorter hospital stay	32 (53)	16 (25)	**< 0.001**
Clinical improvement	49 (82)	40 (63)	**< 0.001**
Make a diagnosis	33 (55)	31 (49)	**< 0.001**
"LP is a safe investigation"*	38 (63)	38 (60)	**0.048**
LP knowledge score (SD)	3.9 (1.5)	3.6 (1.8)	0.341
Practices, *n* (%)			
Would agree to LP for the following†			
Self	47 (78)	39 (62)	0.14
Relative	45 (75)	40 (63)	0.34
This admission			
LP requested	57/60 (95)	61/63 (97)	0.67
LP completed	43/57 (75)	24/61 (39)	**< 0.0001**

LP = lumbar puncture. Bolded P-values are significant at $P < 0.05$.
* Agree or unsure.
† Agree. LP = lumbar puncture; USD = U.S. dollars..

was a significant source of LP information, whereas 38% (47/123) obtained information from their community.

Although 70% (86/123) of all patients/caregivers knew that LPs were used to diagnose meningitis, far fewer knew that LP could be used to treat headache (6/123, 5%); 78% (96/123) of all patients/caregivers thought that an LP could be replaced with a blood test. Pediatric caregivers were more likely to report that LP can be replaced by neuroimaging than adult patients/caregivers (90% of pediatric caregivers versus 78% of adult patients/caregivers, $P < 0.01$).

Nearly all patients and caregivers reported that LP was painful for patients. Fear of death was reported by 50% (61/123) of all patients and caregivers. Pediatric caregivers were more likely than adult patients/caregivers to report that LP could make patients worse and could result in paralysis (both $P = 0.01$). Adult patients/caregivers were more likely than pediatric caregivers to indicate that LP was necessary to make a diagnosis (55% versus 49%, $P < 0.001$) and could result in clinical improvement for the patient (82% versus 63%, $P < 0.001$).

Patient/caregiver LP knowledge scores ranged from 0 to 7, with a mean of 3.73 for all patients and caregivers. Scores did not differ significantly between adult patients/caregivers and pediatric caregivers ($P = 0.341$). There were no significant predictors of increased LP knowledge (Table 4).

Doctors and nurses. Twenty doctors and 30 nurses were interviewed from the wards where eligible patients or caregivers were recruited. No providers declined interview; 40% (8/20) of doctors and 50% (15/30) of nurses worked in the Children's Hospital. Most physicians (12/20) were in their first 2 years of medical practice. One physician had been practicing for 4 years, and four had been practicing for more than 4 years. Most nurses (21/30) had completed their diploma in nursing, and nine had not. Four nurses were ward supervisors. Only one had completed advanced training. Healthcare workers most frequently cited their medical training as their source of LP-related knowledge (95% doctors and 90% of nurses); however, 76% also cited other HCWs.

Although all HCWs were familiar with LP, only 64% (32/50) knew someone who was not a patient who had undergone the procedure (Table 3). Nurses were less likely than doctors to know that LP could be used to treat headache (3% of nurses versus 75% of doctors, $P < 0.001$). Nurses were also more

TABLE 3
HCW demographics, LP knowledge, attitudes, and practices

	Doctors ($n = 20$)	Nurses ($n = 30$)	P-value
Demographics			
Male gender, *n* (%)	17 (85)	7 (23)	**< 0.001**
Mean age (SD)	31.9 (4.4)	34.1 (7.8)	0.23
Marital status, *n* (%)			0.54
Married	13 (65)	21 (70)	
Divorced	0 (0)	1 (3)	
Never married	7 (35)	8 (27)	
Household size			
Mean adults (SD)	2.6 (1.1)	3.4 (1.5)	0.06
Mean children (SD)	1.0 (1.0)	2.1 (1.6)	**0.01**
Mean wealth USD (SD)	7,233 (5,016)	4,299 (476)	0.1
High-density housing (%)	1 (5)	8 (29)	**< 0.01**
Years of employment at the University Teaching Hospitals	3.35	5.4	0.058
LP knowledge, *n* (%)			
Heard of LP	20 (100)	30 (100)	–
Personal experience with LP	12 (60)	20 (67)	0.13
LP should be recommended for the following Patients with meningitis	19 (95)	27 (90)	0.64
Adults and children	20 (100)	30 (100)	1.0
LP can be replaced by the following*			
A blood test	4 (20)	10 (34)	0.18
A CT or MRI scan	3 (15)	13 (43)	**0.046**
LP attitudes, *n* (%)			
Risks†			
Painful	19 (95)	28 (93)	1.0
Cause infertility	1 (5)	1 (3)	1.0
Cause paralysis	11 (43)	19 (30)	0.803
Lead to death	10 (50)	11 (37)	0.31
Make people worse	11 (55)	3 (10)	**< 0.01**
Benefits†			
Shorter hospital stay	20 (100)	21 (70)	**0.03**
Clinical improvement	19 (95)	21 (70)	0.09
Make a diagnosis	17 (85)	30 (100)	0.06
"LP is a safe investigation"†	19 (95)	27 (90)	0.26
LP knowledge score (SD)	6.4 (1.1)	5.9 (1.2)	0.212
LP practices, *n* (%)			
Would agree to LP for the following†			
Self	19 (95)	27 (90)	0.76
Relative	20 (100)	28 (93)	1.0

Bolded values are significant at $P < 0.05$.
* Agree or unsure.
† Agree. HCW = healthcare worker; LP = lumbar puncture; USD = U.S. dollars.

likely than doctors to report that LP can be replaced by neuroimaging (43% of nurses versus 15% of doctors, $P = 0.046$).

Although HCWs largely agreed that LP was safe, concerns about LP-related risks were common (Table 3); 30% (19/30) of nurses and 43% (11/20) of doctors indicated that LP could cause paralysis; 37% (11/30) of nurses and 50% (10/20) of doctors also reported it could cause death even when performed correctly.

Healthcare worker LP knowledge scores ranged from 3 to 7, with a mean of 6.1 (SD 1.15). Doctors and nurses had comparable LP knowledge scores ($P = 0.21$). Healthcare workers who knew someone who had undergone an LP who was not their patient had greater LP-related knowledge (6.8 versus 5.9, $P < 0.001$, Table 4). Household wealth was also associated with a higher LP knowledge score ($P = 0.03$).

Predictors of LP completion. In total, 95% (57/60) of adult patients and 97% (61/63) of pediatric patients had an LP recommended as part of their inpatient diagnostic pathway. Of these, 75% (43/57) of adults and 39% (24/61) of pediatric patients underwent LP ($P < 0.0001$, Table 2). Of the patients/caregivers offered an LP this admission who indicated that they would likely agree to an LP on themselves or their relative, as appropriate, when the questionnaire was administered, 75% (64/85) underwent to the procedure during the current admission; 25% (21/85) did not undergo the procedure despite indicating they would likely agree during questionnaire administration (McNemar's test $P = 0.0002$).

On multivariable modeling, the patient/caregiver LP knowledge score was associated with increased likelihood of LP completion (OR 1.62 [95% CI: 1.19–2.23], $P = 0.002$, Table 5). Patients/caregivers who reported that LP could cause paralysis were less likely to undergo LP (OR 0.29 [95% CI: 0.11–0.77], $P = 0.014$). Pediatric patients were also less likely to undergo LP, after controlling for other covariates (OR 0.18 [95% CI: 0.07–0.47], $P \leq 0.001$). There were no significant interactions between variables.

DISCUSSION

Although patients, caregivers, and HCWs generally agreed that LP is a safe procedure, concerns about risks were frequent, and poor LP uptake was common among participants, particularly among pediatric patients. Limited LP knowledge and fears of paralysis were highly predictive of low LP uptake among our patient population. Fear of death is anecdotally cited as a reason for LP refusal in Zambia,[8] yet it was not predictive of LP completion in our study. Although others have examined predictors of LP refusal and shown higher rates of likely acceptance than those in our study, these were often completed among nonhospitalized individuals and, as our data illustrate, likely acceptance may not translate to eventual LP completion.[6] Therefore, it is possible that prior studies examining likelihood of LP acceptance among healthy individuals who are not being asked to consent to the procedure may underestimate the rate of LP refusal in those settings.

Although HCWs were found to have relatively high LP-related knowledge, they commonly reported the same procedure-related fears as their patient population. Historically, among patients with space-occupying lesions, one percent of LPs may cause death due to cerebral herniation.[12] Rates of herniation are lower among those with meningitis, and data suggest LP may be safely completed among comatose children with signs of increased intracranial pressure and early herniation because of suspected cerebral malaria.[13] Despite their rarity, HCWs concern for these complications as well as their comfort with LP, particularly in regions where neuroimaging is not available, may influence their willingness to perform the procedure in seriously ill patients. It may also influence how they approach patients or their caregivers for consent. In sub-Saharan Africa,

TABLE 4
Predictors of increased LP knowledge score

	Knowledge score (SD)	*P*-value
Patients and caregivers		
Gender	Male: 3.70 (1.8) Female: 3.74 (1.7)	0.91
Age	Correlation –0.077 (0.5)	0.40
Patient type	Adult: 3.9 (1.5) Pediatric: 3.6 (1.9)	0.34
Formal education		0.44
Primary	3.6 (1.7)	
Secondary	3.6 (1.7)	
Advanced	4.6 (1.5)	
None	4.3 (1.3)	
Household wealth mean	Correlation: 0.17 (2.89)	0.06
Know someone who has had an LP	Yes: 3.71 (1.8) No: 3.77 (1.6)	0.87
Doctors and nurses		
Gender	Female: 6.0 (1.2) Male 6.2 (1.1)	0.70
Age	Correlation –0.003 (< 0.001)	0.98
Healthcare worker type	Doctor: 6.4 (1.1) Nurse: 5.9 (1.2)	0.21
Years at the University Teaching Hospitals	Correlation: 0.25 (6.6)	0.07
Household wealth mean	Correlation: 0.31 (9.5)	**0.03**
Know someone who has had an LP*	Yes: 6.8 (0.42) No: 5.9 (1.2)	**< 0.001**

Bolded values are significant at $P < 0.05$.
* Personal contact, not a patient. LP = lumbar puncture.

TABLE 5
Predictors of LP completion (n = 112)

Variable	Univariable OR [95% CI]	Multivariable OR [95% CI]
Participant demographics		
Male gender	0.88 [0.39–1.98] P = 0.76	–
Age	0.99 [0.97–1.03] P = 0.76	–
Education	P = 0.96	–
None	0.70 [0.17–2.81]	
Primary	Referent	
Secondary	0.89 [0.40–2.00]	
Advanced	1.04 [0.16–6.97]	
Household wealth	1.0 [1.0–1.0] P = 0.82	–
Prior experience with LP	0.82 [0.38–1.78] P = 0.61	–
Patient characteristics		
Pediatric patient	**0.21 [0.096–0.47] P=< 0.001**	**0.18 [0.07–0.47] P < 0.001**
Male gender	1.41 [0.61–3.26] P = 0.43	–
Karnofsky/Lansky score	0.995 [0.98–1.01] P = 0.35	–
HIV-positive	**3.13 [1.27-7.73] P = 0.01**	2.98 [0.979–9.098] P = 0.055
Days ill before admission	1.04 [0.99–1.08] P = 0.11	–
Days since admission	**1.15 [1.05–1.26] P < 0.01**	1.01 [0.99–1.02] P = 0.46
LP knowledge, attitudes, and practices		
Knowledge score	**1.78 [1.37–2.31] P < 0.0001**	**1.62 [1.19-2.23] P = 0.002**
Fear of death	**0.18 [0.080–0.41] P < 0.0001**	0.488 [0.164–1.453] P = 0.698
Fear of paralysis	**0.161 [0.072–0.361] P < 0.001**	**0.29 [0.11–0.77] P = 0.014**

LP = lumbar puncture; OR = odds ratio. Bolded values are significant at $P < 0.05$.

where consumables to perform LP may be scarce, laboratory capacity is often limited, and delays occur in reporting results,[14] HCWs may realize few benefits from performing a LP relative to perceived LP-related risks, thereby limiting the motivation to provide more detailed information, especially when facing reluctance from patients and families. Accurately characterizing the impact that this and other health systems barriers may have on care for adults and children with possible meningitis will be essential to improve LP uptake in Zambia.

Given the association between limited LP knowledge among patients and caregivers in our study and LP uptake, improving LP education among both patients/caregivers and HCWs may improve procedure completion in Zambia. A multitiered approach that includes community engagement is imperative, given our study findings of a high reliance on sources of LP-related information that were outside of the formal healthcare setting. Educational interventions should consider engaging trusted community members or leaders to aid with the dissemination of accurate LP-related information. This approach has been shown to improve HIV knowledge, reduce stigma, and improve testing in the Democratic Republic of Congo and Tanzania.[15,16] Educational efforts in the healthcare setting may also be beneficial. Task-shifting informed consent for LP to counselors or nurses with specialized training regarding the procedure may be one opportunity to increase knowledge among families and reduce burden on busy physicians, especially in cultures where multiproxy consent is common. Arts-based performance in the community have been shown to increase medical literacy in rural Ghana[17] as well as decrease stigmatizing attitudes and improve uptake of HIV testing in South Africa and Botswana.[18,19] Therefore, including arts-based performance at health dissemination events in healthcare facilities, where patients and families frequently spend hours waiting to see health providers, may address LP misconceptions among patients and family members as well as HCWs. This ancillary benefit has been shown previously in Zambia with stigma interventions. Atadzhanov et al.[20] found that programming aimed at pupils resulted in improved epilepsy-related attitudes and practices among teachers. Other interventions such as handouts could be considered; however, these would be limited by literacy, and those interviewed in this study overwhelmingly used other individuals to meet their educational needs instead of hospital posters addressing LP myths.

This study was conducted at the highest level of medical care in Zambia in an urban setting; therefore, it may not be applicable to rural Zambia or elsewhere in sub-Saharan African where cultural differences, availability of resources, and disparities in neurologic expertise may impact LP practices. As this was a cross-sectional study, it is possible that patients/caregivers agreed to LP later in their admission, and we may have underestimated LP uptake in our patient population. In cases where an LP does not occur early in the hospital admission, HCWs must make treatment decisions without CSF results and may select empirical therapy to treat multiple possible underlying etiologies.[3] Delayed LP uptake may result in sterilization of CSF which complicates efforts to discontinue unnecessary treatments and may result in unintended patient harm.[21,22] Studies from Pakistan and Singapore suggest that patients who do not undergo LP are more likely to refuse other medical interventions and to be discharged against medical advice.[23,24] Additional investigation is warranted to investigate this association and the role the patient–HCW relationship plays in these outcomes.

Received May 19, 2020. Accepted for publication January 18, 2021.

Published online March 22, 2021.

Acknowledgments: We would like to thank the patients, caregivers, and healthcare workers at the University of Zambia's University Teaching Hospitals for making this study possible as well as Grace Mwanangombe, Chalwe Musonda, Juliet Namwinwa, and Gloria Habanyama for their assistance with data collection.

Financial support: This study was funded by NIH 5R25NS065729-11, R01NS094037, Norman Kagan Endowed Scholarship in Graduate and Professional Studies; Blake W. H. Smith Scholarship.

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