West African Journal of Pharmacy (2021) 32 (2) 49 - 61

Knowledge of mothers on the use of oral liquid dosage preparations in Jos, Nigeria: an educational intervention

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ABSTRACT

Background: Liquid medicines are usually recommended for infants and younger children. However, errors are made by caregivers during dosing and administration.

Objective: To determine the effect of an educational intervention on mothers regarding the knowledge and use of oral liquid medicines.

Methods: The intervention was carried out in the Plateau State Epidemiological Unit, and involved educating mothers on the correct knowledge and handling of oral liquid medicines. Data were collected by interview and observational methods using a validated questionnaire. Paired t-test and binary logistic regression analyses were used, with statistical significance set at $p \leq 0.05$.

Results: The average age ± SD of the mothers was 28.8±4.6 and 5.17±6.18 months for the children. The mean knowledge score was 6.08±0.08 out of 7. A significant increase in mean knowledge level of mothers from 0.060±0.017 (pre-) to 0.830±0.027 (post-intervention), and the percentage of mothers who accurately measured the liquid preparation from 5.9% to 83.3% were observed. Mothers with adequate knowledge of liquid dosages were 4.3 times more likely to measure the unit liquid preparations accurately (p=0.016, CI: 1.31-14.13).

Conclusion: The educational intervention significantly increased the mean knowledge level of mothers about liquid medicines, and the percentage of mothers who accurately measured the paediatric liquid preparation.

Keywords: Paediatrics, Medication administration errors, liquid medicines, Educational Intervention, Nigeria

Connaissance et utilisation des préparations orales liquides par les mères à Jos, au Nigeria : Une intervention éducative

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RÉSUMÉ

Contexte : Les médicaments liquides sont généralement recommandés pour les nourrissons et les jeunes enfants. Cependant, des erreurs sont commises par les soignants pendant le dosage et l'administration.

Objectif : Déterminer l'effet d'une intervention éducative sur les mères concernant la connaissance et l'utilisation des médicaments liquides oraux.

Méthodes : L'intervention a été menée dans l'unité épidémiologique de l'État du Plateau et a consisté à éduquer les mères sur la connaissance et la manipulation correctes des médicaments liquides oraux. Les données ont été recueillies par des méthodes d'interview et d'observation à l'aide d'un questionnaire validé. Des analyses de test T apparié et de régression logistique binaire ont été utilisées, la signification statistique étant fixée à p=0,05.

Résultats : L'âge moyen ± ET des mères était de 28,8±4,6 mois et de 5,17±6,18 mois pour les enfants. Le score de connaissance moyen était de 6,08±0,08 sur 7. Une augmentation significative du niveau de connaissance moyen des mères de 0,060±0,017 (pré-intervention) à 0,830±0,027 (post-intervention), et le pourcentage de mères qui ont mesuré avec précision la préparation liquide de 5,9% à 83,3% ont été observés. Les mères ayant une connaissance adéquate des médicaments liquides étaient 4,3 fois plus susceptibles de mesurer avec précision la préparation liquide unitaire (p=0,016, IC : 1,31-14,13).

Conclusion : L'intervention éducative a augmenté de manière significative le niveau moyen de connaissances des mères sur les médicaments liquides, et le pourcentage de mères qui ont mesuré avec précision la préparation liquide pédiatrique.

Mots-clés : Pédiatrie, erreurs d'administration de médicaments, médicaments liquides, intervention éducative, Nigeria.

INTRODUCTION

The development of formulations appropriate for children can present significant challenges to the pharmaceutical scientist because potential paediatric patients may include neonates, toddlers, young children and adolescents, all of whom, will have widely varying needs. Thus, certain considerations should be made in the development of paediatric dosage forms. Age-appropriate formulations are dosage forms which can deliver variable doses accurately, based on age/weight/surface area consideration, deliver an accurate dose, safe and acceptable to the child, matched to development and ability, and avoid medication error.[1] Rational drug use of paediatric medications is applied using the 5 'Rs': Right child, Right medication, Right dose, Right time, Right route and procedure. Any of the "5 Rights" gone wrong' becomes a medication error,[2] which is defined by the National Coordinating Council for Medical Error Reporting and Prevention (NCCMERP) as "any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient, or consumer".[3]

Studies have shown that administration errors account for the highest rate (72-75%) of medication errors in paediatric practice (other medication errors are: 3-37% - prescribing and 5-58% - dispensing errors).[4] Medication administration errors are classified into six categories: wrong timing (greater than one hour difference compared with the ordered time), wrong dose (quantity), wrong drug, wrong frequency, wrong duration and wrong route. Therefore, the prescription, dispensing and administration of medications represent a substantial portion of preventable medical errors that occur in paediatric therapy.[5]

Patient education is "the process of influencing patient behaviour and producing the changes in knowledge, attitudes, and skills necessary to maintain or improve health".[6] It can be structured using the Bloom's taxonomy of learning objectives, which guides the transfer of knowledge and provides a basis for evaluation, including the extent to which such learning has occurred.[7] Bloom's taxonomy classifies learning into three categories: cognitive, affective and psychomotor. This study focused more on the cognitive (knowledge) and psychomotor (use/handling of liquid medicines) categories of the objectives.

Oral liquid formulations are typically prescribed to young children, however, many parents find accurate measurement challenging and complex.[8,9] Studies have suggested that parents frequently misunderstood instructions regarding how to administer medication to their children correctly, with over 40% of caregivers making errors in dosing liquid medications.[4,10,11] Those with low health literacy, as well as those with limited English proficiency were at particular risk for medication administration errors.[12,13] The variability in measures can also contribute to parents' confusion with dosing especially for those individuals with limited literacy.[14] The ability to understand the importance and correct use of standardized dosing instruments (e.g., oral syringe, dropper, dosing cup), as well as the ability to interpret measurement units (e.g., milliliter, teaspoon, tablespoon), are among the key skills that help parents avoid making error.[13,15] This will ensure rational drug use so that optimal therapeutic outcomes are achieved.

Health literacy is defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make accurate health decisions.[16] Health literacy encompasses the skills involved in all aspects of an individual's ability to address health-related issues, including their ability to read and understand written health information (print literacy), comprehend mathematical concepts such as risks/benefits of treatment choices (numeracy), listen to and understand spoken health information (oral literacy), and navigate the health care system. Parents with low health literacy have higher odds of choosing a nonstandard dosing tool compared to parents with adequate health literacy.[17] As part of health literacy for example, the Food and Drug Administration (FDA) is urging consumers to carefully read the labels of liquid acetaminophen marketed for infants to avoid giving the wrong dose to their children.[18] Outcomes linked to limited health literacy include greater mortality and poorer global health status, increased hospitalizations, and emergency care use.[19,20] Health literacy has been shown to be related to health outcomes as seen in the conceptual model proposed in Figure 1.[16]

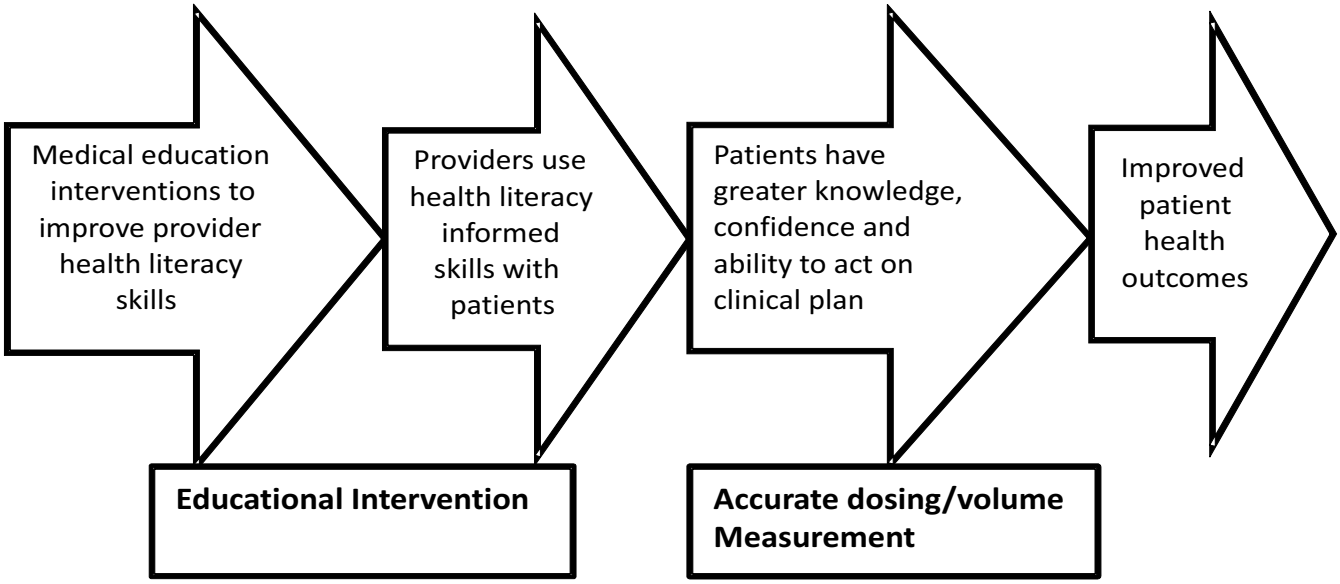

Figure 1: Health-literacy-related outcomes: From medical education to improved patient health.[16]

Medication administration errors place children at risk for adverse events, may contribute to therapeutic failure, and can result in avoidable health care costs. It is therefore imperative that the correct dosage and volume of paediatric liquid medications are determined and administered so as to achieve optimal therapeutic effect and successful treatment outcome.[21,22]

A study showed that medication errors were common, as 39.4% of parents made an error in measurement of the intended dose, 41.1% made an error in the prescribed dose, and 16.7% used a nonstandard instrument.[23] Similarly, a study done in Liberia showed that only 25.5% of mothers accurately measured liquid dosage preparations.[24] The objective of this study was to determine the effect of an educational intervention on mothers regarding the knowledge and use of oral liquid medicines in Jos, Plateau State.

METHODS

Study design and setting

The intervention study was done in the State Epidemiological Unit of the Plateau State Ministry of Health, Jos. Plateau state shares boundaries with Benue, Nasarawa, Kaduna, Taraba and Bauchi states. The Plateau State Ministry of health (SMOH) is located in the complex of the Plateau State secretariat. It serves as link between the Federal Ministry of Health and the Local Government Health authority. The study was carried out in the vaccination/immunization and nutrition sub-units of the epidemiological unit, where mothers come regularly for their children's routine vaccination.

Ethical consideration

Ethical approval (PSSH/ADM/ETH.CO/2017/005) was sought and obtained from the Health Research Ethics Committee of Plateau State Specialist Hospital. Permission to collect data was gained from the Plateau State epidemiological officer. After careful explanation of the intent of the research to the respondents, written consent was obtained before administration of the questionnaire. Participation was voluntary and the respondents were allowed to withdraw from the research at any point. Data collected were treated with utmost confidentiality as they were collected without identifiers and anonymity was maintained throughout the period of data collection and analysis.

Population/sampling

The study population was mothers, who brought their children for routine vaccination at the Plateau State epidemiological unit from July, 2017 to December, 2017. Sampling was done conveniently as mothers came to the unit.

Sample size determination

A minimum sample size of 172 was obtained using the Fisher's formula: $N = Z^2pq/d2$, where: p was the proportion of mothers who accurately measured liquid medicine = 0.115,[25] the margin of error (d) was 0.05 and 10% attrition for loss to follow up was included.

Data collection

Data were collected from mothers who brought their children (ages 0-5 years) for routine vaccination through self-administration, interview, and observational methods, with the aid of a validated questionnaire. The 26-item questionnaire was divided into four sections: respondent's consent, demography, knowledge, and use of liquid medicines. To ensure that complete and correctly filled questionnaires reached the minimum sample size target, a total of 200 questionnaires were administered. The mothers were taught by trained research assistants on the proper use and disposal of liquid medicines.

Data analysis

Data were collated and cleaned with Microsoft® Excel. Data analysis was done using frequency distribution for descriptive analysis, Chi-square, Binomial logistic regression and paired t-test with the aid of Statistical Package for Social Sciences version 24 (IBM, Chicago, IL, USA). A p-value ≤0.05 was considered to be statistically significant. The respondents' knowledge level was graded based on percentiles, where respondents at or below the 25th percentile (total knowledge score, less or equal to 5 out of 7) were classified as having low knowledge, those in the 50th percentile, with a total knowledge score of 6 out of 7 were classified as having moderate knowledge, and respondents in the 75th percentile (total knowledge score of 7 out of 7) were classified as having high knowledge. For the purpose of binary logistic regression analysis, the respondents were classified as having adequate knowledge for the 75th percentile, and less than 75th percentile for inadequate knowledge. The main outcome measure was the mothers' knowledge level of liquid medicines.

Intervention

Before the intervention, mothers were asked if they had ever given liquid medicines to their children. Those that indicated 'yes' were recruited into the study. The mothers were asked if they read and understood the package insert in liquid medicines and knew what quantity of medicine to give their children. They were also asked how they handled administering more than one liquid medicine to a child, as well as administering liquid medicines to more than one child, and what they did with left over medicines. Those that gave incorrect answers were recorded and taught the correct handling and disposal of liquid medicines. To test the accuracy of volume measurement, the mothers were given water in a paracetamol syrup bottle and told to measure 5 ml using the 10 ml unit dispensing cup commonly found in the cap of liquid medicine bottles. The volume measured was poured into a 10 ml glass measuring cylinder (Pyrex®) to check the accuracy of measurement. If correct, the mother was told to repeat the measurement immediately. If wrong, the mother was told to rest for about 15 minutes before repeating the measurement, where she was taught to read the 5 ml mark at eye level, and below the meniscus. All observations were recorded manually before transferring to a personal computer. All the mothers who were interviewed from the structured questionnaire participated in the intervention study.

RESULTS

Demographic characteristics

Out of 200 questionnaires distributed, 186 were completely filled, giving a percentage response rate of 93%. The mean age ± Standard Deviation was 5.17 ± 6.18 months for the children and 28.8 ± 4.6 years for the mothers. Most of the mothers were businesswomen and housewives resident in Jos-North, with tertiary level of education as seen in Table 1.

Use of liquid medicines

About 67.2% of the mothers knew the name of the medicine(s) they give to their children, 90.3% read the medicine's package insert, but only 63% understood what was written in the insert. All the mothers (100%) reported to have given liquid medicines to their children before, with 95.7% using it based on prescription by a health worker. The remaining 4.3% got instructions for the dose/amount of the medicine to give the child from the package insert. The handling of liquid medicines by mothers is summarized in Table 2.

Knowledge assessment

The mean knowledge score ± Standard error of mean (SEM) was 6.08±0.08 out of a score of 7. Knowledge level was significantly associated with mothers' monthly income and educational level as seen in Table 3. Holding all other factors constant, knowledge level was significantly associated with the respondents' level of income. In addition, the respondents with adequate level of knowledge of the medicines given to their children were 4.3 times more likely to measure their children's medicine correctly than those with inadequate knowledge as seen in Table 4. Additionally from Table 5, mean knowledge score increased significantly from 0.06 before the intervention to 0.83 after the intervention.

Table 1: Demographic Distribution (N=186)

Variable	Sub-Category	Frequency	Percentage
Gender	Male	90.0	48.4
	Female	96.0	51.6
Child age group (Months)	0 – 6	134	72.0
	7 – 12	38	20.4
	13 – 24	12	6.5
	>24	2	1.1
Mother's age group (Years)	16 – 25	46	24.7
	26 – 35	125	67.2
	36 – 45	15	8.1
Address	Jos North	98	52.6
	Jos South	66	35.5
	Jos East	10	5.4
	Other LGAs	12	6.5
Mother's occupation	Student/Applicant	24	12.9
	Employed	46	24.7
	Housewife	55	29.6
	Business	61	32.8
Mother's monthly income (Naira)	None	54	29.0
	<18,000	68	36.6
	>18,000	64	34.4
Level of education	No Formal Education	2	1.1
	Primary	8	4.3
	Secondary	74	39.8
	Tertiary	102	54.8
Religion	Christian	143	76.9
	Muslim	43	23.1
Ethnic group	Hausa	26	14.0
	Igbo	18	9.6
	Yoruba	10	5.4
	Other tribes	132	71.0

LGAs=Local Government Areas

Table 2: Use of liquid medicines **N=186**

Variable	Frequency	Percentage
Knowledge of name of medicine given to child		
No	22	11.8
Yes	125	67.2
Some	39	21.0
Do you read the medicine's packet insert?		
No	14	7.5
Yes	168	90.3
Sometimes	4	2.2
Do you understand the packet insert?		
No	30	16.1
Yes	117	62.9
Partially	39	21.0
What is done with left over after medicine administration		
Wash it away	138	74.2
Lick it	14	7.5
Add water to it and give child	34	18.3
Administering more than one liquid medicine		
Use same cup/spoon	60	32.3
Change cup/spoon	71	38.2
Wash before using for another liquid medicine	55	29.6
Having more than one child to give liquid medicine		
Use same cup/spoon	31	16.7
Use different cup/spoon	118	63.4
Wash same cup/spoon and use for another child	37	19.9
Type of measure commonly used		
10 ml cup	89	47.8
Teaspoon	4	2.2
Graduated dropper	20	10.8
More than one	73	39.2
Preferred measure		
10 ml cup	127	68.3
Teaspoon	7	3.7
Graduated dropper	52	28.0
Measure of spoon/cup (before intervention)		
Incorrect	175	94.1
Correct	11	5.9
Measure of spoon/cup (after intervention)		
Incorrect	31	16.7
Correct	155	83.3

Table 3: Association between Knowledge Level and Respondent's Characteristics (N=186)

Variable	Sub category	Low	High	Medium	Total	χ^2 (*p*)
Child gender	Male	25	43	22	90	0.33 (0.85)
	Female	25	44	27	96	
Child age (Months)	0 – 6	34	63	37	134	2.73 (0.89)
	7 – 12	10	18	10	38	
	13 – 24	5	5	2	12	
	> 24	1	1	0	2	
Mother's age (Years)	16 – 25	16	24	6	46	7.48 (0.11)
	26 – 35	29	58	38	125	
	36 – 45	5	5	5	15	
Address	Jos North	22	50	26	98	5.59 (0.47)
	Jos South	20	30	16	66	
	Jos East	5	3	2	10	
	Other LGAs	3	4	5	12	
Mother's occupation	Student/Applicant	6	13	5	24	3.09 (0.80)
	Employed	10	23	13	46	
	Housewife	18	21	16	55	
	Business	16	30	15	61	
Monthly income (**Naira**)	None	11	26	17	54	9.54 (0.05)*
	<18,000	27	26	15	68	
	>18,000	12	35	17	64	
Educational level	No formal education	1	1	0	2	19.880 (0.001)*
	Primary	6	0	2	8	
	Secondary	24	27	23	74	
	Tertiary	19	59	24	102	
Age of weaning child	Not applicable	2	2	1	5	0.68 (0.85)
	1-2 years	48	85	48	181	
Frequency of child falling ill	Never	19	36	11	66	7.13 (0.28)
	Rarely	23	33	25	81	
	Sometimes	8	16	11	35	
	Often	0	2	2	4	
Preference for a type of unit dose measure	10 ml cup	39	56	32	127	3.76 (0.45)
	Teaspoon	2	3	2	7	
	Dropper	9	8	15	52	
Measure of 10 ml cup 1	Incorrect	48	44	83	175	2.04 (0.35)
	Correct	2	5	4	11	
Measure of 10 ml cup 2	Incorrect	17	5	9	31	14.790 (0.001)*
	Correct	33	44	78	155	

LGAs= Local Government Areas, 1=Pre-intervention, 2=Post-intervention,
**Significant at p = ≤ 0.05*

Table 4: Factors Associated with Mother's Knowledge Level (N=186)

Variable	Sub-category	df	*P*	Odds Ratio	95% C.I. for OR Lower	Upper
Gender (Child)	Male[1]					
	Female	1	0.718	1.862	0.387	1.924
Age (Child)		1	0.192	0.961	0.904	1.020
Age (Mother)		1	0.449	1.035	0.949	1.131
Address	Other LGAs[1]					
	Jos North	1	0.463	1.976	0.321	12.178
	Jos South	1	0.976	1.029	0.167	6.337
	Jos East	1	0.749	0.691	0.072	6.654
Education	No formal[1]					
	Primary	1	0.702	0.500	0.014	17.451
	Secondary	1	0.741	1.715	0.070	41.902
	Tertiary	1	0.503	3.079	0.114	82.785
Occupation	Student/Applicant[1]					
	Employed	1	0.209	2.595	0.586	11.497
	Housewife	1	0.476	1.734	0.382	7.872
	Business	1	0.107	3.426	0.765	15.341
Income	None[1]					
	<18,000	1	**0.006***	0.182	0.054	0.610
	>18,000	1	0.228	0.436	0.113	1.680
Type of measure	10 ml cup[1]					
Used	Teaspoon	1	0.515	0.250	0.004	16.210
	Dropper	1	0.832	1.227	0.186	8.115
	More than one	1	0.669	1.225	0.484	3.102
Preferred measure	10 ml cup[1]					
	Teaspoon	1	0.467	3.270	0.134	79.556
	Dropper	1	0.099	2.687	0.830	8.703
Use of cup measure 1	Incorrectly[1]					
	Correctly	1	0.643	0.653	0.107	3.969
Use of cup measure 2	Incorrectly[1]					
	Correctly	1	**0.016***	4.295	1.306	14.127

[1]*=Reference group, 1=Before Intervention, 2=After Intervention, *Significant at p* = ≤ 0.05

Table 5: Paired samples test of mean knowledge pre and post intervention (N=186)

	Mean±SEM	Mean Difference	t	df	*p*	95 % CI	
						Lower	Upper
Measure 1	0.06±0.017	-0.77±0.03	-25.185	185	**0.000**	-0.834	0.714
Measure 2	0.83±0.027						

SEM=Standard Error of Mean, 1=Pre-Intervention, 2=Post Intervention

DISCUSSION

This intervention study was designed with the aim of improving mothers' ability to accurately measure paediatric liquid medicines, so that the dosing is correct, side/adverse effects are minimized; which optimizes positive therapeutic outcomes such as prevention, cure and/or relief of symptoms. The factors associated with knowledge level were educational level, monthly income and the intervention, where mothers with adequate knowledge level of liquid medicines were four times more likely to measure the oral liquid preparation more accurately than if they had not.

Use of liquid medicines

Most mothers read the liquid medicine's package insert as similarly reported,[24] but fewer mothers understood what they read as similarly observed in a study.[26] The pharmacist can fill this gap to increase health literacy by ensuring that directions for use, especially dose regimen are well explained to, and understood by caregivers. The majority of mothers used paediatric medicines based on prescription from a health worker and from the package insert, which will likely minimize dosing and drug administration errors, while promoting rational drug use.

For the disposal of liquid medicines, the majority of mothers washed it away and used a different dosing cup when a different child was administered liquid medicine at the same time. This was considered commendable as contamination and cross-infection would be minimized. However, 32.3% of mothers reported using the same dosing cup for more than one liquid medicine. This may lead to drug-drug interaction and/or administration of wrong volumes of medicine since there is a residue of the previous medicine administered. Mothers would therefore need to be educated on the importance of using different measuring devices for different medicines or washing the previous one thoroughly before use for another medicine.

Most mothers preferred the 10 ml dosing cup than the teaspoon and graduated dropper as similarly reported,[24] probably because the dosing cup is the most commonly available unit dosing measure. However, dosing errors are common with the cups. Therefore as a general rule, they should not be used for doses less than 5 ml even if the cup has calibration less than 5 ml.[26,27] Studies have shown inconsistency in accurate measures using kitchen spoons and teaspoon,[26,28] as the notion was that the teaspoon is equivalent to 5mls while the tablespoon is equivalent to 10 mls.[29,30] A study confirmed a wide variability in the volume typical household teaspoons and tablespoons hold and their unreliability of the dosing, thus their use should no longer be recommended.[29]

Infants and small children would benefit more from the use of a medication syringe since their sucking reflex is still high. Oral syringe is the instrument of choice of health care professionals when maximal accuracy is desired. Medicine spoons work well with children over the age of 3 or 4 years.[8] This study did not show any significant relationship between choice of measuring device and knowledge level, probably because what mattered most was the accuracy of measurement. This is in spite of the fact that the dosing cup has been shown to be associated with higher dosing errors.[13,26]

There is a growing recognition that health literacy is a dual function, involving not only an individual's literacy skills when a task is approached but also how to understand and correctly follow instructions.[31] The health professional particularly the pharmacist, nurse and physician needs to be aware that many care givers still use inaccurate dosing measures for liquid medicines especially household spoons. They have a huge responsibility to educate and encourage care givers to use more accurate measures such as the dosing syringe during unit dose measurements of liquid medicines. They

should also consider the possibility of medication dosing error when faced with treatment failure.[26] Before the intervention, 94.1% of the mothers did not measure liquid medicine with the dosing cup correctly. This was also observed in a study where 75% of mothers measured incorrectly.[24] This could be from those with low educational/knowledge level as reported from other studies.[11,23,30] However, since the higher percentage may have included mothers with high educational level, the dosing error may have been due to high dosing error associated with dosing cups as previously stated.[26] A study reported that mothers who used spoons or teaspoons measurements were twice likely to make errors in dosage administration than those who used milliliter measurements.[23]

Knowledge assessment

It was observed from this study that parents with low educational level had lower knowledge level about liquid medicines and their use, and would more likely make dosing errors compared to parents with higher educational level. Low health literacy has been found to be associated with suboptimal medication use.[23,30] Mothers with lower education levels can be properly educated by the pharmacist on the appropriate measuring device that will measure the unit dose correctly. From the study, mothers with adequate knowledge were 4.3 times more likely to measure liquid medicines accurately than mothers with inadequate knowledge level, indicating a positive effect of the intervention, as similarly reported in other studies.[5,30]

Effect of educational intervention on the accuracy of measuring liquid medicines.

There was a significant increase in mean knowledge score and ability to measure liquid medicines correctly post-intervention compared to pre-intervention, implying a positive effect of the intervention. In addition, parents with low health literacy had higher odds of choosing a non-standard dosing tool compared to parents with adequate health literacy.[17] An assessment of the possibilities of drug administration errors showed that most parents who claimed to have adequate knowledge on dosage schedule were wrong. This was evidenced by the high value of 88.5% - 100% total errors obtained before the intervention. However, significant improvement was observed after the intervention. With proper training, parents were better able to dose liquid medication accurately, understand and adhere to correct dosing, timing, and duration as seen from the results obtained after the intervention.[5]

The educational intervention overall improved the ability of the mothers to accurately measure paediatric liquid dosage preparations and handle liquid medicines correctly. Because dosing errors are the most common medication error, it is therefore crucial for healthcare providers to ensure that the appropriate drug and dose are prescribed to children, especially neonates, because of their differences in response to drugs compared with adults. Pharmacists can help prevent medication errors by checking dosing calculations, screening for drug-drug interactions, and counseling caregivers on proper administration and medication-storage safety tips.[32] Given that a large proportion of parents use cups,[8] and many medications are packaged with a cup, a further study is indicated to address how to improve parents' ability to measure accurately with cups and to determine whether packaging standards should be changed.

This study was limited by the difficulty in following-up the same set of mothers on another day due to the different days they would have to return for the next vaccination of their children. Hence, the follow up was done on the same day with the intervention.

CONCLUSION

The educational intervention significantly increased the mean knowledge level of mothers about liquid medicines from 0.06 ± 0.017 to 0.83 ± 0.027 and the percentage of mothers who accurately measured the paediatric dosing cup from 5.9% to 83.3%. The public health and policy implications include: the need for health professionals to educate mothers or care givers when prescribing, dispensing and administering paediatric liquid medicines. Regulatory bodies should ensure that manufacturers comply with the guidelines for the manufacturing, calibration of dosing devices, marketing, and distribution of orally ingested paediatric liquid medicines. Caregivers should ensure adherence to prescribing and administrative instructions, since the ability to deliver liquid medicines to the child successfully in the volume administered is important for optimal therapeutic effect and successful treatment outcome.

ACKNOWLEDGMENT

The authors acknowledge the support of Pharm. Simplicius Emeka in data collection, the Plateau State epidemiological officer: Mrs. Martina Nuwan, and staff of the Plateau State Epidemiological unit, as well as the mothers who participated in this study.

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