

## Original Article

## The Effect of the Health Literacy Levels of Parents on Medication Errors

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### Abstract

**Background/aim:** The health literacy levels of parents affect the medication errors and thus it is considered that reliable and effective medication administration are important factors in the prevention of the medication errors. In this study, it was aimed to determine the effect of the health literacy levels of parents on medication errors.

**Materials and methods:** The cross-sectional study was conducted with 106 parents who had 0-1 year-old infants. The data of the study were collected by using Socio-Demographic Characteristics Data Collection Form and Medication Errors Data Collection Form. Furthermore, PHLAT-8 was used to determine the health literacy levels of parents.

**Results:** The 69.8% of the parents had sufficient health literacy levels. The most frequent medication errors of parents were made omission dose error (51.9%), wrong time errors (35.8%), wrong dose (27.4%). According to the results of the study, medication error possibility of parents with limited health literacy levels was 0.77 times more than the medication error possibility of parents with sufficient health literacy levels. The age and education status of parents affect the medication errors.

**Conclusions:** In our study, we detected that insufficient health literacy levels of parents can increase the medication error possibilities. Furthermore, we concluded that ages of parents and medication errors were not significantly related to each other. According to our results, we recommend to improve the health literacy levels of parents who have 0-1 infants in order to decrease the medication errors.

**Key words:** Health Literacy; Parents; Medication Errors; Nursing

### Introduction

Medication administrations were performed by nurses in health institutions. However, treatments can also be performed at home by patients and parents due to technological advances, increased number of chronic diseases, and increase in the life span (Walsh et al. 2013). Children are prone to medication errors due to their physiological and developmental characteristics. Application of medications at home increases possible errors and thus damages. Infants are in the fastest immature development process and thus it is more possible that particularly infants are negatively affected by medication errors compared to older children (Payne et al, 2007; Sandlin 2008). Number of studies on medication errors in children has also increased over the last decade as it has been in adults and these studies mostly focus on clinical medication errors.

Limited numbers of studies show that children are exposed to medication errors and these studies indicate that medication errors can be preventable and they are related to the medication management (Zandieh et al., 2008; Yin et al., 2012).

The health literacy levels of parents affect the medication errors and thus it is considered that reliable and effective medication administration are important factors in the prevention of the medication errors (Luthy et al., 2012; Berkman et al., 2004; Yin et al., 2009; Yin et al., 2010). In this study, it was aimed to determine the effect of the health literacy levels of parents on medication errors.

### Materials and Methods

**Setting and sample:** The cross-sectional study design was used. The data were collected in two

university hospitals, two pediatric hospital between February-May, 2015. The cross-sectional study was conducted with parents who had 0-1 year-old infants in order to determine how their health literacy levels affect their medication errors. Totally 106 parents were involved in the study. We included parents who had 0-1 year-old infants, who accepted to participate in the study, who were literate, who did not have an hearing or visual impairment, and who did not have any mental problem.

**Measurements:** The data of the study were collected by using Socio-Demographic Characteristics Data Collection Form and Medication Errors Data Collection Form. Furthermore, PHLAT-8 was used to determine the health literacy levels of parents.

Parent Socio-Demographic Characteristics Data Collection Form is composed of questions which are about the age, educational status, and the number of children. Medication Error Data Collection Form is composed of 15 questions which are related to different scenarios. We applied this form to determine the parental medication errors.

It was developed by Kumar and colleague and revised by Yin and colleague (Kumar et al., 2010; Yin et al., 2012). It is composed of 8 items. PHLAT-9 is composed of two parts. In the first part, there were visual materials such as the packages of medicine boxes and of infant nutrition products. There were questions in the second part of the form and visual materials were provided to parents in order to ensure them to answer the questions. Parents were asked to answer questions by reading and examining these materials. Five of the questions were related to nutrition, two of them were related to drug doses, and one of them was about allergies. The application time of the test is approximately 15-20 minutes. Numbers are used as codes in PHLAT-8 test; such as "1" is for right answers and "0" is for wrong answers. The maximum score that can be obtained from the test was "8" whereas the minimum score can be "0" (Yin et al., 2013). The internal coefficient value of PHLAT-8 is  $KR-20=.64$ . Topuz conducted the reliability and validity of PHLAT-8 test in Turkish samples and they found the internal coefficient value as  $KR-20=.68$  (Topuz, 2021).

**Data collection:** The data of the study were collected by applying face-to-face interview technique to parents whose children were

inpatients in two university hospitals, two pediatric hospital between February-May, 2015. The aim of the research was explained to the parents who were part of the research sampling in the clinics where the research was carried out.

**Data Analysis:** According to the literature, the factors which mostly affect the medication errors of parents were the age, their educational status, and health literacy levels (Yin et al. 2012; Yin et al. 2013; Paasche-Orlow et al. 2005; Cho et al. 2008; Morris et al. 2013). In this regard, we determined the independent variables of the study as age, education and health literacy levels. The dependent variable of the study was the medication errors.

Medication error is any event that defines any difference between the recommended by the physician and the applied by health professionals or parents. The classifications of American Society of Health Systems Pharmacists (ASHP, 1993) are considered to define the types of medication errors. Omission error was defined as the failure to administer an ordered dose to a patient before the next scheduled dose. The wrong time error is defined as one hour deviation from the scheduled time of the medication.

The data of the study were evaluated by using in computer program and the significance level was accepted as .050 ( $p<.05$ ). In order to analyze the data of the study, descriptive statistical methods, correlation analysis, Kruskal Wallis test, and t-tests were used.

**Limitations:** There are limitations to our study. This was a cross-sectional study in which we examined effect of the health literacy levels of parents on medication errors; conclusions about causality cannot be made. The data collection duration was performed in four months in inpatient clinics, it may not reflect how parents actually dosed at home. Future study in which assessments are performed errors at home. We collected the data in newborn parents by PHLAT-8, it is also possible to examine the association between the health literacy and the medication administration errors of parents in later childhood periods and other measurement on health literacy.

**Ethical consideration:** The ethical approval was obtained from ethical committee (B.30.2.SFÜ.00.50.500/43) and permissions from hospitals (69631334-1957-18416, 67938315/799,

23592379/044). The study was explained to all parents and their consents were obtained.

## Results

**Socio-demographic characteristics:** The mean age of parents was  $30.95 \pm 6.38$  (19-43 year-old), 40.6% of them graduated from university, and the expenses of 47.0% of them were lower than their income. The 47.2% of the parents had only one child. The ratio of the family members who did not have any chronic disease was 69.0% (Table 1).

**Health Literacy:** PHLAT-8 test was used to determine the health literacy levels of parents and the wrong answer ratios of PHLAT-8 test can be seen in Table 2. Parents gave wrong answers to the questions about the amount of food required to prepare for their babies respectively with the ratios of 40.6% and 59.4% in the first and second items. In case of third and fifth items, the drug doses were asked to parents and they gave wrong answers to relevant questions respectively with the ratios of 33.0% and 37.7%. The forth, sixth and seventh items

which showed the knowledge of parents about products were answered wrongly respectively with the ratios of 19.8%, 26.4%, and 39.6%. In case of the eight item, there was an information leaflet about problems encountered during breastfeeding. This question was wrongly answered by 63.2% of the parents (Table 2). The 69.8% of the parents had sufficient health literacy levels, 23.6% of them had limited health literacy levels, and 6.6% of them had insufficient health literacy levels (Table 3).

**Medication Errors:** The most frequent medication errors of parents were made omission dose error (51.9%), wrong time errors (35.8%), wrong dose (27.4%), and administration technique errors (9.4%) (Table 4). According to the results of the study, medication error possibility of parents with limited health literacy levels was 0.77 times more than the medication error possibility of parents with sufficient health literacy levels (GA: 0.61-0.96,  $p < .05$ ). The age and education status of parents affect the medication errors ( $p > .05$ ), (Table 5).

**Table 1. The socio-demographic characteristic of parents (n=106)**

<u>Variables</u>	<u>n (%)</u>
<u>Age</u>	
20 years and under	3 (2.8)
21-30 years	49 (46.2)
31-40 years	49 (46.2)
40 years and over	5 (4.8)
<u>Education</u>	
Primary school	40 (37.7)
High school	23 (21.7)
University	43 (40.6)
<u>Income</u>	
Lower income level	50 (47.1)
Middle income level	16 (15.1)

Higher income level	40 (37.8)
<u>Child number</u>	
One	50 (47.2)
Two	38 (35.8)
Three and more	18 (17.0)
<u>Chronic disease</u>	
No chronic disease in family	74 (69.8)
Mother	18 (17.0)
Father	7 (6.6)
Children	7 (6.6)

**Table 2. PHLAT-8 Answer Ratios (n=106)**

<u>Items</u>	<u>Task</u>	Wrong	True
		<u>n (%)</u>	<u>n (%)</u>
1. item	Follow the instructions to prepare product	43 (40.6)	63 (59.4)
2. item	Follow the instructions to prepare product	63(59.4)	43 (40.6)
3. item	Follow the instructions to prepare product with a measuring spoon	35(33.0)	71 (67.0)
4. item	Interpret to product's information	21(19.8)	85 (80.2)
5. item	Follow the instructions to prepare product with a syringe	40 (37.7)	66 (62.3)
6. item	Interpret to product's information	28 (26.4)	78 (73.6)
7. item	Interpret to product's information	42 (39.6)	64 (60.4)
8. item	Interpret to leaflet	67 (63.2)	39 (36.8)

**Table 3. The health literacy levels of parents**

<u>Health Literacy Levels</u>	<u>n (%)</u>
Insufficient	7 (6.6)
Limited	25 (23.6)
Sufficient	74 (69.8)

**Table 4. Medication errors of parents (n=106)**

<u>Errors</u>	<u>Exp.</u>	<u>n (%)</u>
Omission error	Failure to administer an ordered dose to a patient before the next scheduled dose	55 (51.9)
Wrong time error	One hour deviation from the scheduled time of the medication	38 (35.8)
Wrong dose error	Failure to preparation of medication	29 (27.4)
Wrong administration technique	Failure to take the medication with or without a meal as directed	10 (9.4)

**Table 5. Effects of the health literacy levels of parents and socio-demographic characteristics of parents on medication errors**

<u>Variables</u>	<u>Beta</u>	<u>SD</u>	<u>OR</u>	<u>(%95 GA)</u>	<u>P</u>
Health literacy	-0.26	0.11	0.77	0.614-0.963	0.022
Education					
Highschool and below (ref)	0.63	0.66	1.88	0.510-6.956	0.342
Highschool and up					
Age	0.03	0.04	1.04	0.959-1.119	0.373
Regression fixed	0.49	1.26	1.64	-	0.697

## Discussion

**Health Literacy:** In this study which was conducted to define the relationship between the health literacy of parents who had 0-1 year-old infants and their medication errors, it was shown that 70.0% of the parents were sufficient in terms of health literacy (Table 1). According to the two of the studies conducted by Yin and colleague with parents who had children younger than 8 years old, NEWEST was used and it was indicated that 77.0% of the parents and 79.0% of the parents had low health literacy levels (Yin et al 2010; Yin et al. 2013) Yin and colleague applied TOFHLA to parents who had children younger than 1 year-old and they found that 70.0% of the parents had sufficient health literacy levels. Our results are similar to the study conducted by Yin and colleague in 2007. This similarity can be because parents had 0-1 year-old children. On the other hand, the high differences in health literacy levels of parents whose socio-demographic characteristics were similar can be related to the scales used in studies. Even though NEWEST and TOFHLA scales are used to determine the health literacy levels of all adults, PHLAT-8 is a scale which measure only the health literacy levels of parents who had 0-1 year-old infants. We used PHLAT-8 in our study and we recommend conducting similar studies with the larger sample sizes in order to assess the comparability and generalization of our results.

**Medication Errors:** It was determined that the most frequent medication errors of parents were respectively omission dose, wrong time errors, wrong doses, and wrong administration technique. The rate of the errors related to omission doses of parents was 50.0% whereas the wrong time errors rate was more than one third of the parents. Walsh and colleague (2013) determined that one out of every five parents made an error related to omission doses errors. Wallace and colleague (2012) detected that the ratio of parents who made a wrong time error was more than half of the parents whereas Bailey and colleague (2009) showed that almost one third of the parents made wrong time error. Our results are in line with the literature. Parents specified that they missed or postponed the medication doses due to different reasons such as sleeping. These findings are important because parents should be aware of the importance of medications which show their affects according to the blood levels. For instance, antibiotics,

digital drugs, and antiepileptic drugs are these types of drugs which should be administered to the children at the right time. Nurses have important roles in medication administration and they can guide parents in terms of medications.

We detected that approximately one third of the parents made wrong dose errors. In a study which was conducted to determine the home medication errors and it was found that more than half of the parents made medication errors and most of these errors were related to the dosing (Walsh et al 2013). Similar studies showed that half of the parents incorrectly prepared the prescribed medications (Yin et al 2012; Yin et al 2013; You et al 2015). When the reasons of the wrong dose errors were examined, it was reported similar to our study that parents did not shake the bottle of liquid medicine and they did not use the standard spoons. These findings can lead to prioritize the interventions which can improve the knowledge and increase health literacy levels of parents.

In our study, we determined that almost 10.0% of the parents made medication errors. In a study conducted by Walsh and colleague (2013), it was determined in a study that low number of parents made medication application errors. You and colleague (2015) conducted a study in which they determined the home medication errors of parents, they found similar to our findings that 11.0% of the parents most probably did not apply as it was prescribed. According to our results, we detected that parents who made medication administration errors did not conform to the principles of drug prescriptions (such as hunger satiety principle or administration of the medication with foods). This can be because of the parents do not understand and interpret the information about the product.

**Association of the health literacy levels of parents and socio-demographic characteristics of parents with medication errors:** According to our results, there was no statistically significant relationship between the educational status of parents and the medication errors. Bailey and colleague (2009) determined the significant difference between the educational status of parents and medication errors. Kaya and colleague (2011) also concluded that there was a relationship between the educational status and the medication errors. However, in another study was found that the educational levels of parents did not affect the medication errors (Basbakkal et

al 2010). Yin and colleague (2013) specified that there was no association between the educational status and medication errors. Our findings were similar to these results. According to our results, we did not detect any relationship between the educational levels of parents and medication errors and this can be because of that the study was conducted with parents whose infants were inpatients and parents learned how to apply medications during the hospital stay.

In this study, we did not detect any relationship between the ages of parents and medication errors. Bailey and colleague (2009) specified that the age of the parent was an independent variable while assessing the medication errors of parents. On the other hand, Wallace and colleague (2012), Mccarthy and colleague (2013), and Yin and colleague (2013) concluded that medication errors were not significantly related to the ages of parents. Our findings support these results. According to our study, we did not find significant relationship between the ages of parents and medication errors. This can be related to the characteristics of samples.

Our findings showed that there was a significant relationship between health literacy levels of parents and the pediatric medication errors. Parents with insufficient health literacy levels had higher possibility to make medication errors compared to the ones whose health literacy levels were sufficient. It was shown that health literacy levels of parents were not related to medication errors (Mccarthy et al, 2013). Parents who had insufficient health literacy levels could not sufficiently understood the treatment steps and prescribed medications and thus they made medication errors (such as wrong time and wrong dose) (You et al 2015; Wolf et al 2006; Davis et al 2006). It is known that the risk of being affected by medication errors is more in children compared to adults. In the 0-1 age group, immaturity continues in all systems and the health literacy of parents can be directly correlated with the health status of their children. Our results can direct the interventions which can improve the health literacy levels of parents.

**Conclusion:** In our study, we detected that insufficient health literacy levels of parents can increase the medication error possibilities. Additionally, we concluded that ages of parents and medication errors were not significantly related to each other. According to our results, we recommend to improve the health literacy

levels of parents who have 0-1 infants in order to decrease the medication errors.

The results can direct nurses and the other health professionals while defining and planning to increase health literacy level and to reduce medication errors for parents. Furthermore, this analysis may also serve as a baseline from which to examine the improvements made as a result of revisions to federal guidelines and consensus statements intended to reduce the medication error.

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