

# Statistical Analysis of the Different Factors Affecting the Diarrhea

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## Original paper

### SUMMARY

Diarrhea is a worldwide problem facing both developing countries and developed countries, especially in pediatric population. Because of shortage of health facilities and lack of good food in developing countries, it

is known fact that developing countries are facing this death taking problem more. The main purpose of this study was to examine the various factors which affect the recovery time of diarrhea. A multiple linear regression was applied to analyze the data and to select a model. The response variable for the study

was the recovery time of diarrhea. The results of the analysis show that the Zinc is the main factor which affect the recovery time in Peshawar.

**Keywords: Diarrhea, Zinc, Multiple Regression, Sex.**

## 1. INTRODUCTION

Looseness of the bowels with watery of discharges is called diarrhea. The problem is more common in developing countries due to the shortage of health facilities and lack of good food. Diarrhea causes rapid reduction of water and sodium- if the water and salts are not replaced fast, the body starts to remove water or dry up or get dehydrated all of which are the lost contents of water and salt essential for a normal body function. Diarrhea is the most dangerous disease and is responsible for comparatively maximum deaths ratio among child's death. Though the mortality rate for children under five suffering from acute diarrhea has fallen from 4.5 million deaths annually in 1979 to 1.6 million deaths in 2002, acute diarrhea contributes to a high that toll on children in developing countries (1). Over two million children die as a result of diarrhea and dehydration every year (2). In the light of the above statements it is obvious that diarrhea is the most severe and dangerous problem, especially in the pediatric population.

Diarrhea may have different forms such as acute diarrhea, dysentery (blood in stool), or persistent

diarrhea (lasting more than 14 days). Frequent use of antibiotics should be avoided. Anti-diarrhea drugs and anti-emetics should not be given to young children with either acute or persistent diarrhea since they medications do neither prevent dehydration nor improve nutritional status, and some have dangerous side effects. In many countries, children have a low intake of foods rich in readily absorbable zinc, such as liver, red meat, poultry, fish, oysters and crab. Diarrhea is typically more persistent and severe in infants and young children with malnutrition than in children who are not malnourished. Children with severe zinc deficiency commonly have chronic diarrhea, immune deficiency and growth retardation. Zinc can be produced in both syrup and tablet forms. Sazawal *et al.* (3) conducted a study to determine the effects of daily zinc supplementation on the duration and severity of diarrhea in pediatric population. In their study, a total of 937 children were included. Of these children, 462 received oral rehydration therapy. Children who received a daily oral preparation of zinc gluconate (20 mg of elemental zinc) had a 23 percent reduction in the risk of con-

tinued diarrhea, the mean number of watery stools decreased by 39 percent and the number of days with watery stools decreased by 21 percent. The authors concluded that zinc supplementation in this largely malnourished group of children was associated with a statistically significant in the severity and duration of diarrhea. Bhutta *et al.* (4) used *Cox survival regression analysis* to evaluate the overall effect of zinc on continuation of diarrhea and possible differential effects in subgroups divided by sex, age, weight-for-height, and initial plasma zinc concentration. In their study, dichotomous outcomes were analyzed by *logistic regression*. They concluded that zinc supplementation reduces the duration and severity of acute and persistent diarrhea. Lutfi's (5) worked to evaluate the effect of daily zinc supplementation for 14 days on diarrhea duration, severity, and morbidity in children. In his study children were randomly assigned to zinc (n = 150) and control (n=130) groups and received dosages of 15-30 mg elemental zinc daily. His data indicated that supplementing children with acute diarrhea in Turkey with 3 Recommended Daily Allowances (RDA) of elemental zinc for 14 days

improved neither diarrhea duration nor severity despite significant increments in plasma zinc.

So far so many studies have been contacted through the world but no study has been based on the risk factors which affect the duration of diarrhea. This study is an attempt to find the risk factor which directly or indirectly affect the recovery time of diarrhea.

## 2. METHODS AND MATERIALS

The multiple linear regression procedure is used for the analysis of data. The multiple linear regression is an extension of linear regression. The **multiple linear regression model** consists of  $p$  explanatory variables and is written as

$$Y_i = \beta_0 + \beta_1 x_{i,1} + \beta_2 x_{i,2} + \dots + \beta_p x_{i,p} + \varepsilon_i \quad (1)$$

Where  $\varepsilon_i, i = 1, 2, \dots, n$  are independent normally distributed random variables with zero mean and constant variance

$\sigma^2$   $\beta_0, \beta_1, \beta_2, \dots, \beta_p$  are parameters.

In terms of matrix notations we can write the above model as

$$Y = X\beta + \varepsilon$$

The data of 1000 patients were collected from pediatric department Post Graduate Medical Institute Hayatabad Medical Complex Peshawar to examine the different factors which affect recovery time. Out of 1000 child patients, 500 used ORS with zinc and 500 used ORS without zinc. Zinc is considered as the binary variable and is represented by Zinc, age (in months) is continuous variable and represented by Age, weight (in kg) is continuous variable and is represented by Weight, height (in cm) is continuous variable and is represented by Height, sex is categorical (binary) variable and is represented by Sex, residence is categorical (binary) variable and is represented by Resi, and recovery time of diarrhea (in days), is also a continuous variable represented by  $Y_{R\sigma}$ , is a response variable (Dependent variable). In this study

Z, A, W, H, S, and R are independent variables. The multiple regression

$$Y_{R\sigma} = \beta_0 + \beta_1 \text{Zinc} + \beta_2 \text{Age} + \beta_3 \text{Weight} + \beta_4 \text{Height} + \beta_5 \text{Sex} + \beta_6 \text{Resi} + \varepsilon_i$$

$\rightarrow (1), (i = 1, 2, \dots, 1000)$

model was used, for recovery time of diarrhea which has the following

$$Y_{R\sigma} = 6.6956 - 2.4649 \text{Zinc} + 0.0022 \text{Age} + 0.0067 \text{Weight} - 0.0058 \text{Height} - 0.1818 \text{Sex} - 0.0212 \text{Resi}$$

form

By using the SPSS package the result of the analysis is given below

The table gives the detail about the significance of variable.

Basically, ANOVA in the above Table indicates that the independent variables were related to the dependent variable (since F was significant at  $P=0.0001$ ). Furthermore we find that about 50% of the variation in dependent variable (Recovery Time of diarrhea) is explained by the six explanatory variables. Also, in the above Table, seven parameters are estimated:

The intercept, or constant, term; the coefficient for Zinc (Zinc); The coefficient for Age (Age); the coefficient for Weight (Weight); The coefficient for Height (Height);

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	6	1535.21473	255.86912	163.982	0.0001
Error	993	1549.42427	1.56035		
C Total	999	3084.63900			

Root MSE 1.24914	R-square 0.4977
Dep Mean 4.98100	
C.V. 25.07806	

Variable	DF	Parameter Estimate	Standard Error	Wald Test	Significance
INTERCEP	1	6.695590	0.35087247	19.083	0.0001
Zinc	1	-2.464900	0.07921032	-31.118	0.0001
Age	1	0.002155	0.00473070	0.455	0.6489
Weight	1	0.006722	0.03491083	0.193	0.8474
Height	1	-0.005778	0.00604423	-0.956	0.3394
Sex	1	-0.181806	0.08628544	-2.107	0.0354
Resi	1	-0.021249	0.08679652	-0.245	0.8067

**Table 1.** Information about the risk factors (ANOVA)

the coefficient for Sex (Sex); The coefficient for Resident (Resi). Each parameter estimate was based on one degree of freedom. For each parameter estimate, a standard

error was estimated along with a t-statistic and a P-value for the t-statistic. The t-statistic is simply the parameter estimate divided by its standard error, and it is based on the number of degrees of freedom for the error term.

Table indicates that Zinc is significant at  $\alpha=0.01$  and is the cause effect of dependent variable Y or in simple words; Zinc is the variables bring changes in the dependent variable Y. Although at  $\alpha=0.05$  Sex is also significant but not at 0.01.

## 3. DISCUSSION AND CONCLUSION

The results given in Table tells us that it was really Zinc (Zinc) and somewhat i.e. at 0.05 Sex (Sex) that caused the recovery time. The regression coefficient for Age (Age), Weight (Weight), Height (Height), and Resident (Resi) are not statistically significantly different from zero having respective P-values ( $P=0.6489$ ,  $P=0.8474$ ,  $P=0.3394$ , and  $P=0.8067$ ). The fact that the intercept was not significantly different from zero is irrelevant here. The intercept merely tell us where the regression line (or plane, in this case) crosses the y-axis, and does not explain any variation. In our study, zinc is


the only independent (explanatory) variable which is significant. The ANOVA technique provided the strong evidence of the significance of the zinc. Thus we infer that zinc

is a strong explanatory variable and is a main cause in reducing the recovery time of diarrhea.

## REFERENCES


1. Pelletier DLEA, Frongillo Habicht JP. Acute Diarrhea Still a Leading Cause of Child Deaths. *Am J Clin Nutr.* 2005; 82(3): 605-610.
2. Rehman G, Habib MA, Soofi SB, Rehman MU, Rizvi A, Ahmed S, Bhutia ZA. Zinc in different formulations for the treatment of acute gastroenteritis in an earthquake zone: a preliminary experience. *Journal of ATCO laboratory limited.* 2007; 4: 17-20.
3. Sazawal S, Black RE, Menon VP, Dinghra P, Caulfield LE, Dinghra U, Bagati A. Zinc Supplementation in Infant Born Small for Gestational Age Reduces Mortality. *J Pediatr.* 2006; 117( 3): 518-527.
4. Bhutta ZA, Bird SM, Black RE, Brown KH, Gardner JM, Hiday A, Khatun F, Martorell R, Ninh NX, Penny ME, Rosado JL, Roy SK, Ruel M, Sazawal S, Shankar A. Therapeutic effects of oral zinc in acute and persistent diarrhea in children in developing countries: pooled analysis of randomized controlled trials. *Am J Clin Nutr.* 2000; 72(6): 1516-1522.
5. Lutfi KK. Impact of zinc supplementation in children with acute diarrhea in Turkey. *J Pediatr Int.* 2006; 91(4): 296-299.

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Plenary session on *National Journals in an International Context* Juri Engelbrecht, Estonia  
Welcome reception at Tallinn Town Hall

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Plenary session on *Open Access & Digital Models* Deborah Kahn, BioMedCentral  
Plenary session on *Social media and science editing/publishing* Alan Cann, University of Leicester UK  
Parallel sessions  
Optional Conference Dinner at the Brotherhood of Black Heads

**Sunday 10 June**  
Parallel sessions  
Plenary session on *The Editorial Office* Linus Svensson, Oikos, Sweden  
Closing ceremony - the conference will close at 1.00 pm  
Optional course: How to be a successful journal editor by Pippa Smart

**Monday 11 June**  
Optional course continued: How to be a successful journal editor by Pippa Smart  
BELS Examination

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