ISSN: 2578-7365

Research Article

Journal of Chemistry: Education Research and Practice

Application of Multinomial Logistic Regression Model on Factors that Affects the Need for Children Among Ethiopian Women

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Submitted: 28 May 2022; **Accepted**: 04 Jun 2022; **Published**: 07 Jul 2022

Citations: *Habitu Liyew Molla, Turufat Seifu Moges. (2022). Application of Multinomial Logistic Regression Model on Factors that Affects the Need for Children Among Ethiopian Women. J Chem Edu Res Prac, 6(2), 251-257.*

Abstract

Background: *Need for children (desire for children), is one of the major factors influencing the population dynamics. Like other fertility preferences, it is not fixed but changes over the family life course in respect to actual fertility experiences and outcomes. The objective of this study was to identify socio-economic and demographic factors that affect the need for another child (desire for more children) among Ethiopian women of reproductive age (15-49).*

Methods: *The study was based on Ethiopian Demographic and Health Survey (EDHS), 2016 data. A total of 15,683 women with complete information were considered in the study. A Multinomial Logistic Regression Model, a family of generalized non-linear models, were used to identify determinant factors for the need to children (desire for children) among women in Ethiopia using STATA 14 and SPSS 23.*

Results: *Results showed that among the reproductive age women's 65.51% were need to have childe, and their average age was 25.05, 27.18% were don't like to have child and their average age was 35.73, the rest 7.31% of the women were not decide where they need children or not and their average age was 24.8.From multinomial logistic regression model, Region, contraception using (for yes 0.658293 (0.58889, 0.73586) for undecided 0.6310024 (0.50151, 0.79394)), marital status, age of women(for yes 0.896552 (0.88968, 0.90348) for undecided 0.9282431 (0.91632, 0.94033)), number of living children, religion, age at first marriage (for yes1.057528 (1.04363, 1.07161) for undecided 1.041 (1.01434,1.06836)), wealth index, women's employment and women's education were significant effect on the need for children among Ethiopian women.*

Conclusions: *This study was based on a nationwide large sample demographic and survey conducted by the Ethiopian Statistical Agency. The study has empirically investigated and identified the determinants factors that affect the need for children among Ethiopian women. The multinomial logistic regression model analysis identified that variables such as marital status, contraception using, number of living children, age at first marriage and age of women play vital role in deciding on weather women need to have children or not. Region contraceptive using women's employment, women's education level and number of living children have negatively associated with outcome variable.*

Keywords: Need for Children, EDHS, Multinomial Logistic Regression

Background

Fertility is one of the elements in population dynamics that has significant contribution towards changing population size and structure over time. Fertility and future projected population growth are much higher in sub-Saharan Africa than in any other region of the world [1, 2] About eight percent of the world's population lives in high fertility countries that have experienced only limited fertility decline to date. Most of these countries are in sub-Saharan Africa [3, 4].

In 1970's Ethiopia has experienced a very high rate of population growth as in other developing countries. The country's population in 2016 was estimated around 100 million, placing it as the second most populous nation in sub-Saharan Africa and ranks twelfth in the world [5]. The Ethiopian government and international organizations have tried to reduce the pace of growth by education in family planning and providing contraceptives. Despite these efforts, there is still a higher fertility rate than what is considered. Fertility behavior influences population growth, it has consequences on resources, employment situation, health and other social facilities. The mechanism of factors affecting fertility is that intermediate variables influence fertility directly, while socio-economic and demographic variables affect fertility indirectly through intermediate variables [6].

Several factors contribute for the rapid growth in population size. Some of these factors could be literacy status, occupation, religion, child birth- death ratio, wealth status, place of residence, household headship, contraceptive use, region, reproductive life span, age at first marriage and desired number of children [7, 8]. Some studies have mentioned the importance of the role of men in reproductive health and their influence on the decision-making and behavior related to reproduction [9, 10]. As mentioned, many family planning programs have focused mainly on women. Even though men are increasingly being involved by reproductive health programs, the view of men still seem to be that they are peripheral and problematic [10]. Studied fertility preferences and demands for contraception in Ethiopia [11]. The authors reported a gender difference between husbands and wives in fertility desires; husbands were more Pronatalist than their wives. Studied husband-wife communication related to family planning and the use of contraceptives in Kenya [12]. The authors reported that the wife's perception of her husband's approval of family planning has a significant impact on the current contraceptive use. The result shows that men's opinion and perception regarding reproduction have a strong impact on women's perception and their subsequent behavior. Therefore, it is important to study both gender's perception related to reproductive, as well as the communication between wife and husband, in order to understand what factors, shape their behavior.

The desire to bear more children is one main reason for rapid population growth. Desired family size can take many forms. Refers to desired family size as the number of children wanted in one's lifetime, and can be viewed as the demand for children [13]. Defines desired family size as the number of children parents would have if there were no subjective or economic problems involved in regulating fertility [14]. Desire for children is a biological urge and women in every part of the globe, be it a developed nation like America or a poor nation like Ethiopia, all need to bear children [1, 2].

Several studies investigated factors that affect desired family size using some statistical methods such as logistic regression model and count regression model: aimed to determine desired family size and identify factors that influence family size among residents of Assela town, Ethiopia by using logistic regression model [5]. Adopted a generalized linear model (GLM) with a natural log- link function - Poisson regression [15].

Ethiopia has predominantly rural based society whose livelihood depends on individual level farming. In this kind of set up children are expected to help their parents in their efforts to feed their families. Regardless of their number of living children, still want to have four or more children. This study was aimed to assess the need for another child and the potential factors influencing the need for children by women at reproductive age using multinomial regression models.

Methodology

Data for the Study

The data for the present study was taken from the 2016 Ethiopian Demographic and Health Survey (EDHS), a nationally representative survey that was conducted under the authority of the Ethiopian Central Statistical Agency in collaboration with the Federal Ministry of Health (FMoH) and the Ethiopian Public Health Institute (EPHI), with technical assistance from International Consultancy Fund (ICF). The survey was conducted from January 18, 2016, to June 27, 2016, based on a nationally representative sample that provides estimates at the national and regional levels and for urban and rural areas. The survey target groups were women aged 15–49 and men aged 15–59 in randomly selected households across Ethiopia. A total of 18,008 households were selected using two-stage stratified cluster sampling method of which 17,067 were occupied. Of the occupied households, 16,650 were successfully interviewed, yielding a response rate of 98%.

Sample Size for the Study

A total of 15,683 women were considered in this study. These women were asked questions on the background characteristics such as region, age, education level, household headship, living children, contraception using, place of residence, wealth index, work, religion, marital status, family size, age at first marriage.

Statistical Model

In this study, the variable of interest is a categorical variable. When the response or dependent variable (need for children) is a categorical which can take values (No, Yes, and Undecided), it is appropriate to use non-linear models based on non-normal distribution to describe the relationship between the dependent variable and a set of predictor variables. Logistic regression is a popular modeling approach when the dependent variable is dichotomous or polytomous. This model allows one to predict the log odds of outcomes of a dependent variable from a set of independent variables that may be continuous, discrete, categorical, or a mix of any of these [16]. The most attractive feature of a logistic regression model is that it neither assumes linearity in the relationship between the covariates and the outcome variable, nor does it require normally distributed variables. It also does not assume homoscedasticity and in general has less stringent requirements than linear regression models [17].

Multinomial logistic regression is used to predict categorical placement in or the probability of category membership on a dependent variable based on multiple independent variables. Independent variables can be either dichotomous (i.e., binary) or continuous (i.e., interval or ratio in scale) [18, 19]. Multinomial logistic regression is a simple extension of binary logistic regression that allows for more than two categories of the dependent or outcome variable. Like binary logistic regression, multinomial logistic regression uses maximum likelihood estimation to evaluate the probability of categorical membership. Multinomial logistic regression does necessitate careful consideration of the sample size and examination for outlying cases. Like other data analysis procedures,

initial data analysis should be thorough and include careful univariate, bivariate, and multivariate assessment. Specifically, multicollinearity should be evaluated with simple correlations among the independent variables. Also, multivariate diagnostics (i.e. standard multiple regression) can be used to assess for multivariate outliers and for the exclusion of outliers or influential cases [20].

Results

Descriptive Result

A total of 15,683 women were included in the study. Of all women studied, 27.18% were not need (desire) a child, 65.51% were desire to have a child and the rest 7.31% of the women were not decide whether they need child or not. The mean number of living children for those who are not willing a child was 4.1 and their average age was 35.73 in contrast the mean number of living children for those who are willing a child was 1.6 and their average age was 25.05. From the total women 65.89% live in rural areas, 44.84% of women were uneducated and 63.83% were not have any work to do. More than 62.64% women were married and More than Two third of the women households were headed by males (Details can be found in Table 1, 2, 3).

Table 1: Descriptive Statistics for the Need of Another Child

Need for more children	Freq.	percent	cum.
No	4,263	27.18	27.18
Yes	10,274	65.51	92.69
Undecided	1,146	7.31	100
Total	15,683	100	

Table 2: Mean and Standard Deviation of the Need for More Children Among Women Aged 15-49 In Each Category of the Explanatory Variables

Need for more children	Summary of number of living children		
	Mean	std. dev.	freq
No	4.1792165	2.4385011	4,263
Yes	1.634125	2.0643704	10,274
Undecided	1.6300175	2.4134136	1,146
Total	2.3256392	2.4729884	15,683
Need for more children	Summary of women's age in years		
	Mean	std. dev.	freq
No	35.732114	8.3883071	4,263
Yes	25.054896	7.4090024	10,274
Undecided	24.804538	9.1693536	1,146
Total	27.938915	9.1596236	15,683

Table 3: Proportion of Need for More Children Among Women Aged 15-49 And Proportion of Women in Each Category of the Explanatory Variables

Need for more children		No (%)	Yes (%)	Undecided (%)	Total (%)
Contraception using	Not Using	3,065(24.77)	8,278(66.91)	1,028(8.32)	12,371(78.88)
	Using	1,198(36.17)	1,996(60.26)	118(3.57)	3,312(21.12)
Region	Tigray	442(26.27)	1,174(69.79)	66(3.94)	1,682(10.72)
	Afar	169(14.98)	850(75.35)	109(9.67)	1,128(7.19)
	Amhara	626(36.41)	978(56.89)	115(6.7)	1,719(10.96)
	Oromia	673(35.57)	972(51.37)	247(13.06)	1,892(12.06)
	Somali	167(12.00)	1,109(79.72)	115(8.28)	1,391(8.87)
	Benshangul G.	383(34.10)	700(62.16)	43(3.74)	1,126(7.18)
	SNNPE	559(30.23)	1,120(60.57)	170(9.2)	1,849(11.79)
	Gambela	332(32.17)	662(64.14)	41(3.69)	1,035(6.59)

	Harari	282(31.12)	509(56.18)	115(12.7)	906(5.78)
	Addis Ababa	344(18.85)	1,381(75.71)	99(5.44)	1,824(11.63)
	Dire Dawa	286(25.28)	819(72.41)	26(2.31)	1,131(7.23)
Sex of household head	Male	2,907(26.78)	7,157(65.94)	789(7.28)	10,853(69.20)
	Female	1,356(28.07)	3,117(64.53)	357(7.4)	4,830(30.80)
Place of Residence	Urban	1,173 (21.93)	3,831(71.63)	344(6.14)	5,348(34.10)
	Rural	3,090 (29.92)	6,443(62.64)	802(7.44)	10,335(65.90)
Wealth index	Poorest	1,037(25.15)	2,785(67.56)	300(7.29)	4,122(26.28)
	Poorer	816 (31.43)	1,611(62.24)	169(6.33)	2,596(16.55)
	Middle	791(27.77)	1,858(54.70)	199(17.53)	2,848(18.15)
	Richer	752(26.75)	1,828(65.03)	231(8.22)	2,811(17.92)
	Richest	867(26.22)	2,192(66.30)	247(7.48)	3,306(21.10)
Women's Employment	Not working	2,492(24.89)	6,705(66.97)	814(8.14)	10,011(64.47)
	Working	1,771(31.22)	3,569(62.92)	332(5.86)	5,672(35.53)
Women's education	No Education	2,670(37.96)	3,898 (55.42)	465(6.62)	7,033 (44.84)
	Primary	1,091(20.92)	3,654(70.09)	468(8.99)	5,213(33.23)
	Secondary	335(14.96)	1,749(78.15)	154(6.89)	2,238(14.27)
	Higher	167(13.92)	973(81.15)	59(4.93)	1,199(7.66)
Religion	Orthodox	1,817(28.33)	4,201(65.50)	395(6.17)	6,413(40.89)
	Catholic	32(35.16)	51(56.04)	8(8.80)	91(0.58)
	Protestant	903 (32.08)	1,677(59.59)	234(8.33)	2,814(17.94)
	Muslim	1,467(23.62)	4,243(68.33)	499(8.05)	6,209(39.59)
	Traditional	24(29.26)	52(61.90)	8(8.84)	84(0.53)
	Other	20(27.77)	50(69.44)	2(2.79)	72(0.47)
Marital status	Single	234(5.46)	3,423(80.01)	621(14.53)	4,278(27.27)
	Married	3,162(32.18)	6,241(63.52)	421(4.3)	9,824(62.64)
	Separated	867(54.83)	610(38.58)	104(6.59)	1,581(10.09)

Model Result

The results from multinomial logistic regression model given in Table 4, showed that Region, contraception using, marital status, age of women, number of living children, religion, age at first marriage, wealth index, women's employment and women's education were statistically significant predictors for the outcome variable.

Table 4: Result of Multinomial Logistic Regression Parameter Estimation Table with Reference No

	Need for children					
	Yes			**Undecided**		
	RRR (95% CI)	**Z**	**p>|z|**	**RRR (95% CI)**	**Z**	**p>|z|**
Region (Ref. Tigray)						
Afar	1.50199 (1.13952, 1.97976)	2.89	0.004	4.72637 (3.06335, 7.29219)	7.02	0.000
Amhara	0.39735 (0.32751, 0.4820)	-9.36	0.000	0.91746 (0.64578, 1.30344)	-0.48	0.631
Oromia	0.35947 (0.29182, 0.44279)	-9.62	0.000	1.89695 (1.33252, 2.70048)	3.55	0.000
Somali	3.10598 (2.35840, 4.09053)	8.07	0.000	6.03279 (3.89810, 9.33651)	8.07	0.000
Benshangul G.	0.44467 (0.35482, 0.55726)	-7.04	0.000	0.59645 (0.38013, 0.93419)	-2.26	0.024
SNNPE	0.59777 (0.47780, 0.74787)	-4.50	0.000	1.58441 (1.07881, 2.32696)	2.35	0.019
Gambela	0.47369 (0.37028, 0.60598)	-5.95	0.000	0.69318 (0.43125, 1.11422)	-1.51	0.130
Harari	0.34319 (0.26624, 0.44240)	-8.26	0.000	1.9592 (1.29887, 2.95523)	3.21	0.001

Addis Ababa	0.69952 (0.55381, 0.88358)	-3.91	0.000	0.85894 (0.56856, 1.29765)	-0.72	0.470
Dire Dawa	0.61019 (0.47636, 0.78161)	-3.91	0.000	0.37251 (0.21805, 0.63641)	-3.61	0.000
Contraception using (Ref. No)						
Yes	0.65829 (0.58889, 0.73586)	-7.36	0.000	0.63100 (0.50151, 0.79394)	-3.93	0.000
Place of residence (Ref. urban)						
Rural	1.00151 (0.86859, 1.15477)	0.02	0.983	0.99962 (0.80050, 1.24828)	-0.00	0.997
Sex of household head (ref. male)						
Female	0.97147 (0.86093, 1.09623)	-0.47	0.639	0.89343 (0.74225, 1.07540)	-1.19	0.233
Wealth index (Ref. poorest)						
Poorer	0.85143 (0.73386, 0.98784)	-2.12	0.034	0.86858 (0.67714, 1.11414)	-1.11	0.267
Middle	1.05713 (0.90758, 1.23131)	0.71	0.475	1.03498 (0.80518, 1.33036)	0.27	0.788
Richer m	1.14255 (0.97642, 1.33693)	1.66	0.096	1.21076 (0.94148, 1.55706)	1.49	0.136
Richest	0.99933 (0.85136, 1.17302)	-0.01	0.993	0.96140 (0.74223, 1.24529)	-0.30	0.76
Women employment (Ref. Not employed)						
Working	0.92648 (0.83899, 1.02298)	-1.51	0.131	0.72142 (0.61209, 0.85026)	-3.89	0.000
Women's education (Ref. NO Edu.)						
Primary	0.89644 (0.79493, 1.01092)	-1.78	0.075	0.78638 (0.64503, 0.95871)	-2.38	0.017
Secondary	1.15645 (0.96445, 1.38668)	1.57	0.117	0.66296 (0.49770, 0.88310)	-2.81	0.005
Higher	1.60852 (1.27396, 2.03094)	4.00	0.000	0.71951 (0.48778, 1.06134)	-1.66	0.097
Religion (Ref. Orthodox)						
Catholic	0.52693 (0.29511, 0.94085)	-2.17	0.030	0.65508 (0.26629, 1.61153)	-0.92	0.357
Protestant	0.87135 (0.74240, 1.02271)	-1.69	0.092	0.84795 (0.65683, 1.09469)	-1.27	0.206
Muslim	1.17848 (1.02881, 1.34991)	2.37	0.018	0.96911 (0.77568, 1.21078)	-0.28	0.782
Traditional	1.78872 (0.99317, 3.22151)	1.94	0.053	2.46786 (1.00083, 6.08531)	1.96	0.050
Other	1.55154 (0.81407, 2.95707)	1.33	0.182	0.54914 (0.12148, 2.48245)	-0.78	0.436
Marital status (Ref. Single)						
Married	1.34549 (1.11293, 1.62665)	3.07	0.002	0.16851 (0.12709, 0.22342)	-12.37	0.000
Separated	0.29732 (0.24198, 0.36532)	11.54	0.000	0.16018 (0.11788, 0.21765)	-11.71	0.000
Age of women	0.89655(0.88968, 0.90348)	27.81	0.000	0.92824(0.91632, 0.94033)	-11.28	0.000
Number of living children	0.74009 (0.71528, 0.76576)	-17.30	0.000	0.85049(0.80415, 0.89951)	-5.66	0.000
Family size	1.00564(0.98028, 1.03165)	0.43	0.666	1.03535(0.99862, 1.07345)	1.88	0.059
Age at first marriage	1.05753 (1.04363, 1.07161)	8.29	0.000	1.041 (1.01434, 1.06836)	3.04	0.002
Cons	247.93 (170.89,359.69)	29.04	0.000	14.82 (8.34, 26.37)	9.17	0.000

The parameters of observed variables from the multinomial logistic regression model can be interpreted as:

The relative risk of comparing regions, women need children to no need for children. The relative risk for having children of women who live in Afar and Somali regions was increased by a factor of 1.501 and 3.1059 than Tigray region respectively, but the relative risk for having children of women who live in Addis Ababa, Amhara, Oromia, Benshangul Gumuz, SNNPE, Gambela, Harari and Dire Dawa was decreased by a factor of 0.6995, 0.3973, 0.3594, 0.4440, 0.5977, 0.4736, 0.3431 and 0.6101 than Tigray region respectively. Moreover, relative risk of comparing regions, undecided women about children to no need for children, for regions Afar, Oromia, Somali, SNNPE and Harari was increased by a factor of 4.72, 1.89, 6.03, 1.58 and 1.95 respectively than Tigray region, for regions Benshangul Gumuz and Dire Dawa the relative risk was decreased a factor of 0.5964 and 0.3725 respectively than Tigray region given that other variables held constant.

From the table 4, women need children to no need for children. For contraception users relative to non-users, the relative risk for having children for contraception users is decreased by a factor of 0.6582 than non-users and the relative risk for undecided women about children to no need for children for contraceptive users is decreased by a factor of 0.6310 than non-users.

The result showed that, undecided women about children to no

need for children, relative risk for unemployed women were decreased by a factor of 0.7214 than employed women.

For comparing women's education, undecided women about children to no need for children. For primary educated women relative to uneducated, the relative risk for having children for primary educated is decreased by a factor of 0.7863 than uneducated and for secondary educated women relative to uneducated, the relative risk for having children for secondary educated is decreased by a factor of 0.6629. And the relative risk of comparing women's education, women need children to no need for children. For higher educated women relative to uneducated, the relative risk for having children for higher educated was increased by a factor of 1.608 than uneducated than uneducated women.

For comparing religion of women, women need for children to women no need for children. For Catholic relative to orthodox follower women, the relative risk for having children for Catholic is decreased by a factor of 0.5269 than the orthodox religion followers, and For Muslim relative to orthodox follower women, the relative risk for having children for Muslim religion followers is increased by a factor of 1.1784 than the orthodox religion followers. More over for Traditional religion followers the relative risk for undecided women to have children for was increased by a factor of 2.4678 than the orthodox religion followers.

When we see the marital status women, women need children to no need for children. For married relative to single, the relative risk for having children for married women's is increased by a factor of 1.3454 than single women and the relative risk for undecided women to no need for children for married women is decreased by a factor of 0.1685 than single women. Moreover, for comparing separated to single women, the relative risk for having children for separated women's is decreased by a factor of 0.2973 than single women and the relative risk for undecided women to no need for children for separated women is decreased by a factor of 0.1601 than single women given that other variables held constant.

A one unit increase in in the variable age of women and number of living children is associated with 0.8965, 0.74 decrease in the relative log of women who need child than doesn't need child respectively. But a one unit increase in the variable age at first marriage is associated with 1.0575 increase in the relative log of women who need child than doesn't need child. A one unit increase in the variable age of women and number of living children is associated with 0.9282 and 0.850 decrease in the relative odds of women with undecided about need of child than who don't need child respectively. In contrast a one unit increase in the variable age of women is associated with 1.041 increase in the relative odds of women with undecided about need of child than who don't need child.

Discussion

This study was based on data from the 2016 Ethiopian Demographic and Health Survey (EDHS), a nationally representative survey that was conducted under the authority of the Ethiopian Central Statistical Agency in collaboration with the Federal Ministry of Health (FMoH) and the Ethiopian Public Health Institute (EPHI). A total of 15,683 women of age between 15 and 49 from the 2016 EDHS data were included in the study.

The study explores on the determinant factors that affect the need for children among Ethiopian women of reproductive age (15–49) using multinomial logistic regression model.

From the model in table 4, the estimated RRR for women's age is positive and show that a unit increment in women's age leads to decline in the relative log of women who need child than doesn't need child. this finding was similar to the result of a study by [9, 10]. In literature most of the studies report a negative relationship between the need of children and age of women. They indicate that younger women have higher likelihood of having higher desired number of children.

A one unit increment in the variable number of living children is associated with 0.74 decline in the relative log of women who need child than doesn't need child. This implies as the number of living child increases the need for another childe decreases, this finding is consistent to study by showed that women having large number of living children were more likely to desire for additional children than those who had small number of living children [21].

From this study, a one unit increase in the variable age at first marriage is associated with 1.0575 increase in the relative log of women who need child than doesn't need child in other words the need for children shows an increment with the increase in age at marriage of the mother. This finding was contrary to the result study by [22]. This inconsistence might be methodology difference, sampling technique and sample size difference.

The relative risk for having children for contraception users was small than non-users This finding is in agreement with study by [23]. This observation holds as a woman who are using contraceptive are less likely to have their expected children than the non-user women.

The fitted model shows that the relative risk for having children for married women's is higher than single women. This finding is consistent with other studies [24]. They believed that married women are more likely to have their expected children than those who are single women.

The relative risk for having children for women's education level were negative and statistically significance. In literature most of the studies also report a negative relationship between the expected number of children and women's education [21]. They indicated that education improves the ability of mothers to implement simple health knowledge and facilitates like family planning methods and contraception using. Furthermore, educated women have greater control over health choices and future plan for their children.

Conclusions

This study was based on a nationwide large sample demographic and survey conducted by the Ethiopian Statistical Agency. The study has empirically investigated and identified the determinants factors that affect the need for children among Ethiopian women. The multinomial logistic regression model analysis identified that variables such as marital status, contraception using, number of living children, age at first marriage and age of women play vital role in deciding on weather women need to have children or not. Women with little or no formal education and with no work tend to have need more children. The desire to limit the number of children increases with age at first marriage. Since the population is growing rapidly poor countries like Ethiopia should take an action in order to minimize the rapid population growth and reduce high fertility rate by preparing continuous trainings and capacity buildings related family planning to those regions with high rates of need for children. Moreover, the government should work on educating women and engaging them in income generating activities should be the among priority policy agendas.

Abbreviations

EDHS: Ethiopian Demographic and Health Survey; GLM: Generalized linear models; FMoH: Federal Ministry of Health; EPHI: Ethiopian Public Health Institute; ICF: International Consultancy Fund.

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