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ARTICLE

Study of postpartum amenorrhea in Uttar Pradesh using exponential distribution for NFHS-5 data

Ravi Kant Maurya[1] , Raman Pant[1] , Anil Kumar [1] and Ridhima Soni[1*]

[1]Department of Statistics, Mahatma Gandhi Kashi Vidyapith, Varanasi, Uttar Pradesh, India.

*Corresponding author. Email: ridhimaverma962@gmail.com

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Abstract

Postpartum amenorrhea (PPA) is a very crucial biological phenomenon in women. Besides this, it is also influenced by various socio-economic determinants. PPA indicates the duration of infecundity among women after childbirth and resumption of ovulation. In this study, the exponential distribution has been fitted to four randomly selected districts of Uttar Pradesh. Data has been taken from the fifth round of the National Family Health Survey. The effect of demographic factors on the PPA of each selected district was analyzed along with education, caste, body mass index (BMI), and wealth index. The findings of this study indicate that in Varanasi the maximum percentage of women in the 0-5 months interval, who have completed secondary education, belong to the OBC category, have normal BMI, and are from the richer and richest category. In Gazipur most women's PPA duration was between 0 to 5 months, and most of them are from the other backward classes category and have completed their secondary education, have normal BMI, and are from the poorest to middle category. In Jaunpur the maximum percentage of women lies in the 0-5 months interval, who have completed secondary education, belong to the OBC category, have normal BMI, and are from the poorer to middle category. In Bhadohi most women's PPA duration was between 0 to 5 months, and most of them are from the other backward classes category and have completed their secondary education, have normal BMI, and are from the poorer to poorest category. All the districts are similar according to distribution and we found that exponential distribution is the theoretical distribution for PPA data of selected districts of Uttar Pradesh.

Keywords: Exponential distribution, PPA, NFHS, and Socio-economic determinants

1. Introduction

Amenorrhea refers to the absence of menstruation after childbirth. During this period, the woman is infertile, and they cannot conceive a child. Therefore, it helps in child spacing. Postpartum Women's bodies go through a lot of adjustment to recover from childbirth, and postpartum amenorrhea plays an important role in receiving good care for the mother and the newborn. PPA indicates restoring the normal hormonal balance in the woman's body and the potential to return to fertility. The duration of postpartum amenorrhea varies widely from woman to woman because it depends on various factors that are different for each woman. Many factors affect the duration of PPA in women. As we can see, many researchers have established that as the duration of breastfeeding increases, the duration of PPA also increases (Mukherjee *et al.*, 1991; Nath *et al.*, 1994; Singh *et al.*, 1999). Davis and Blake's (1956) study "Social Structure and Fertility: An Analytic Framework" mentioned eleven intermediate

variables, and Bongaarts (1978). amenorrhea refers to the absence of menstruation after childbirth. During this period, the woman is infertile, and they cannot conceive a child. Therefore, it helps in child spacing. Postpartum Women's bodies go through a lot of adjustment to recover from childbirth, and postpartum amenorrhea plays an important role in receiving good care for the mother and the newborn. PPA indicates restoring the normal hormonal balance in the woman's body and the potential to return to fertility. The duration of postpartum amenorrhea varies widely from woman to woman because it depends on various factors that are different for each woman. Many factors affect the duration of PPA in women. As we can see, many researchers have established that as the duration of breastfeeding increases, the duration of PPA also increases (Mukherjee *et al.*, 1991; Nath *et al.*, 1994; Singh *et al.*, 1999). Davis and Blake's (1956) study "Social Structure and Fertility: An Analytic Framework" mentioned eleven intermediate variables, and Bongaarts (1978).

Numerous other factors can influence the length of PPA; for example, research indicates that the size of PPA may vary depending on the woman's nutritional status. Undernourished nursing mothers were found to have a longer duration of postpartum amenorrhea relative to better-nourished mothers (Nath & Goswami, 1996; Devi, 2021). According to Valeggia, C. R., & Ellison, P. T. (2001), women with higher energy reserves and better nutritional status tended to endure a shorter time of lactational amenorrhea, while undernourished or metabolically stressed women had extended suppression of ovulation.

Some other factors such as physical recovery, mental health, age of the mother, and parity of the mother make a significant impact on the duration of PPA rather than this, several socio-economic factors such as caste, educational level, and the standard of living index, are responsible for shaping the distribution of the PPA duration of a female (Shukla *et al.*, 2017). Many studies have been done on the duration of PPA. Barrett (1969) used the modified Pascal distribution, which provided a new way to understand how breastfeeding practices affect fertility by influencing the duration of postpartum amenorrhea. Lestheaghe & Pages's (1980) use of a logit model was a key aspect of their research on postpartum amenorrhea (PPA), breastfeeding, and fertility patterns, and Potter and Cobrin's (1981) mixed geometric negative binomial model was intended to account for the fact that different women and population experiences varying durations of PPA due to a range of biological, behavioral, and environmental factors. Nath *et al.* (1993) used a hazard model to examine the effect of breastfeeding on the duration of PPA. They utilized both univariate life tables and multivariate time-dependent hazard techniques. According to a study, a mixture of two Weibull distributions best fits the observations in rural Bangladeshi women (See, Holman *et al.*, 2006). In Bihar, parity, the age of mothers, the survival status of the child, and the socio-economic status of mothers are found to be the main influencing factors for the timing of postpartum amenorrhea and also the duration of breastfeeding among mothers (See, Brajesh *et al.*, 2015). Numerous studies on the length of PPA are accessible in the literature on demographics. According to a study done in a Kolkata slum, PPA lasted an average of 3.5 months, with a range of 0 to 8 months (Suman *et al.*, 2019). The median length of PPA in Manipur was 5.7 months (Singh *et al.*, 2012). For the size of PPA, a bimodal distribution has been noted in West Bengal, Gujarat, Himachal Pradesh, and Andhra Pradesh (Mishra *et al.*, 2021). A study conducted in Lucknow demonstrates that shortened Poisson and displaced negative binomial distributions are viable options for the theoretical distribution of the postpartum amenorrhea period (Yadava *et al.*, 2009). Recently a study was done on the period of post-partum amenorrhea using the hazard analysis approach (Maurya *et al.*, 2024). Another recent study showed a probabilistic study of the duration of postpartum amenorrhea in rural Uttar Pradesh (Maurya *et al.*, 2024).

This paper aims to fit the exponential distribution of the PPA using data from NFHS-5 from four districts of Uttar Pradesh: Varanasi, Gazipur, Jaunpur, and Bhadohi. These four districts were

randomly selected from 75 districts of Uttar Pradesh. This study's results can help and provide valuable insights for developing family planning policies and programs in Uttar Pradesh.

2. Materials and Methods

The data has been taken from the fifth round of the National Family Health Survey (NFHS). The National Family Health Survey provides information on India's population, health, and nutrition, as well as each state, union territory, and district. So far, the five rounds of NFHS have been completed in which NFHS-1, NFHS-2, NFHS-3, NFHS-4, and NFHS-5 were conducted in 1992-93, 1998-99, 2005-06, 2015-16, and 2019-21 respectively. NFHS-5, the fifth round of the NFHS series, provides information on India's population, health, and nutrition, as well as each state/union territory and district. NFHS-5 provides district-level estimates for many important indicators, which collected data on women's characteristics, marriage, fertility, contraception, reproductive health, children's immunizations, treatment of childhood illnesses, and nutrition in the entire sample of NFHS-5 households.

If x represents the duration of postpartum amenorrhea (in months) then the probability density function (pdf) of the exponential distribution of x will be

$$f(x,\theta) = \begin{cases} \theta\, e^{-\theta x} & ;\ x > 0,\ \theta > 0 \\ 0 & ;\ \text{otherwise} \end{cases} \tag{1}$$

$$\overline{x} = \frac{1}{\theta} \text{ and } \sigma^2 = \frac{1}{\theta^2} \tag{2}$$

Here the mean is the average time duration of PPA in women, and θ represents the duration rate of PPA per unit of time in women which is the reciprocal of the mean. As exponential distribution takes value from one, it is suitable for PPA because PPA also takes value from one. Therefore, we are going to examine whether exponential distribution fits the data or not. For the analysis of data initially, the following class intervals (PPA in months) for the distribution of x were made: 0-5, 5-10, 10-15, 1520, 20-25, 25-30, 30-35, and 35-40. The observed value was small in some cells of class intervals; therefore, we merged the cells to improve the analysis.

3. Results and Discussion

Table 1 shows the percentage distribution of PPA in education, caste, BMI, and wealth index for Varanasi in NFHS-5 data. The results for the 20-25, 30-35, and 35-40 months of PPA have been skipped because of lack of information. There is a total of 10.5 % of women participated in PPA with no education among this, 8.2 % of women's PPA duration was 0-5 months, 1.2 % of women's PPA duration was 5-10 months, and 1.2 % of women's PPA duration was 10-15 months. A total of 6.2 % of women with primary education participated in PPA, in which 2.3 % of women's PPA duration was 05 months. 3.5% of women's PPA duration was 5-10 months, and 0.4% of women's PPA duration was 10-15 months. A total of 49 % of women with secondary education participate in PPA, in which 37 % of women's PPA duration was 0-5 months. 8.9 % of women's PPA duration was 5-10 months, and 3.1 % of women's PPA duration was 10-15 months. A total of 34.2 % of women with higher education participate in PPA, of which 26.5 % of women's PPA duration was 0-5 months. 4.3 % of women's PPA period was 5-10 months, 1.9 % of women's PPA duration was 10-15 months, and 1.6% of

women's PPA duration was 15-20 months. According to caste, a total of 17.9 % of SC/ST women participate in PPA, of which 14 % of women's PPA duration was 0-5 months, 3.1 % of women's duration was from 5-10 months, and 0.8 % of women participation was from 10-15 months. A total of 69.3 % of OBC women participate in PPA, which 51.4 % of women's PPA duration was from 0-5 months, 11.7 % of women's PPA duration was from 5-10 months, 4.7 % of women's PPA duration was 10-15 months, and 1.6 % women PPA duration was 15-20 months. A total of 12.8 % of other caste women participated in PPA, which 8.6 % of women's PPA duration was from 0-5 months, 3.1 % of women's PPA duration was from 5-10 months, 1.2 % of women's PPA duration was 10-15 months and 0 % women PPA duration was 15-20 months. According to body mass index, a total of 13.3% of weight women participated in PPA, in which 10 % of women's PPA duration was from 0-5 months, and 3.2 % of women's PPA duration was from 5-10 months. A total of 61.8 % of weight women participated in PPA in which 46.2% of women's PPA duration was from 0-5 months, 9.2 % of women's PPA duration was from 5-10 months, 4.8 % of women's PPA duration was 10-15 months, and 1.6 % women PPA duration was 15-20 months. A total of 24.9 % of overweight women participated in PPA 18.1% of women's PPA duration was from 0-5 months, 5.6 % of women's PPA duration was from 5-10 months, 1.2 % of women's PPA duration was 10-15 months and 0% women's PPA duration was 15-20 months. According to the wealth index, a total of 12.8 % of the poorest women participate in PPA 8.6 % of women's PPA duration was from 0-5 months, 1.9 % of women's PPA duration was from 5-10 months, 1.9 % of women's PPA duration was 10-15 months and 0.4 % women's PPA duration was 15-20 months. A total of 20.2 % of poorer women participated in PPA, which 14.4 % of women's PPA duration was from 0-5 months, 5.1 % of women's PPA duration was from 5-10 months, 0.8 % of women's PPA duration was 10-15 months, and 0% women's PPA duration was 15-20 months. A total of 21 % of middle women participated in PPA 15.2 % of women's PPA duration was from 0-5 months, 3.5 % of women's PPA duration from 5-10 months, 1.6 % of women's PPA duration was 10-15 months and 0.8 % women's PPA duration was 15-20 months. A total of 16.3 % of richer women participated in PPA in which 14 % of women's PPA duration was from 0-5 months, 1.6 % of women's PPA duration was from 5-10 months, 0.4 % of women's PPA duration was 10-15 months and 0.4 % of women PPA duration was 15-20 months. A total of 29.7 % richest women participated in PPA, with which 21.8 % of women's PPA duration from 0-5 months, 5.8 % of women's PPA duration was from 5-10 months, 1.9 % of women's PPA duration was 10-15 months 0 % women's PPA duration was 15-20 months. Here, the maximum percentage lies in the 0-5 months interval, the maximum number of women who have completed secondary education, the maximum number of women who belong to the OBC caste, the maximum number of women who belong to normal weight, and the maximum women who are richer and richest.

The Table 2 shows the percentage distribution of PPA in education, caste BMI, and health index for Gazipur in NFHS-5 data. The table clearly shows that there is a total of 10.5% of women with no education in which 10.3% of women's PPA period was 0-5 months, and petite 7.1% of women have completed their primary education in which 5.7% of women PPA period was 0-5 months. Around 50% of the women have completed their secondary education, of which 38.3% of women's PPA duration was 0-5. Less than one-third of women have completed their higher education, in which 24.1% of women's PPA duration was 0-5 months. According to caste, 60.3% of women are from OBC caste in which 47.5% of women's PPA period was 0-5 months, 33% of women are from SC/ST in which 25.5% got their PPA duration was 0-5 months and 6.1% women are from other castes in which 5.3% women's PPA period was 0-5 months. According to body mass index, 71.6% of women have normal BMI, with over half having a PPA period of 0-5 months. 15.5% were underweight, with 11.9% having 0-5 months of PPA. 12.6% were overweight, with 10.6% having 0-5 months of PPA period. According to the wealth index, a majority of 30.9% was from the poorest, with 23.4% from

the 0-5 PPA group. 21.6% are from the middle, and 19.9% are from the 0-5 PPA group. Only 5.3% are the richest, with 3.9% of them from the 0-5 PPA group.

The Table 3 represents the percent distribution of PPA in education, caste, BMI, and wealth index of Jaunpur in NFHS-5. According to education, this table shows that more than 50% have completed their secondary education, with 43.70% of them from 0-5 PPA duration. Less than one-third have completed their higher education, and 24% are from 0-5 PPA duration. Twelve percent of women have no education, with around 9% of them being from the 0-5 PPA group. According to the Caste, almost 63% are from OBC, with around 50% having a PPA of 0-5 months. 27.20% are from SC/ST, and 22.50% have a PPA duration of 0-5 months. According to BMI, 72.60% have normal BMI, and 64.10% have a PPA duration of 0-5 months. Around 15% are overweight, and around 13% are underweight, and both of them have a maximum percentage of 0-5 PPA months. According to the wealth index, 35.40% are poorer, and 26.20% are from the middle, and both of them have a maximum PPA duration percentage of 0-5 months. We can say that in Jaunpur, most women are from the OBC caste; they have completed their secondary education, and the poorer and middle classes have large participation in PPA and have their PPA in 5 months.

Table 4 represents the percentage distribution of PPA in education, caste, BMI, and weight index of Bhadohi. According to education, 44% have completed their secondary education, and 32.10% have a PPA duration of 0-5 months. Approx 26% have completed their higher education, and 16.60% have a PPA duration of 0-5 months. 20.70% have no education, and 14.30% have a PPA duration of 0-5 months. According to the caste maximum percentage, 61.40% belong to the OBC category, in which 44.40% have a PPA duration of 0-5 months. 24.90% belongs to the SC/ST category, in which 16.10% have a PPA duration of 0-5 months. Only 13.70% belong to the others category, of which 9.10% have a PPA duration of 0-5 months. Body mass index shows 63.20% are normal in BMI, and 43.90% have a PPA duration of 0-5 months. 24.90% are overweight, and 19.30% have a PPA duration of 0-5 months. According to the wealth index, the maximum percentage is from the poorer to medium category, and the maximum number of people with a PPA duration is 0-5 months. We can say that in Bhadohi, the maximum percentage of contributors has completed secondary education, and most are from the OBC category. Most of them have normal BMIs, and most of them are from the poorer to medium categories. Table 5 shows the observed and expected distribution of PPA for the Uttar Pradesh district in Varanasi, NFHS-5. In this table, there is a total 257 number of cases in Varanasi, and we have categorized the months of PPA in class intervals such as 0-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40 months in which 20-40 have been merged because there was not any observation. So, the revised class intervals would be 0-5, 5-10, 10-15, 15-20, 20-40 months. Here, the chi-square value after testing the goodness of fit is 5.24 at 3 degrees of freedom and at a 5% level of significance which is highly insignificant. Therefore, the exponential distribution could be the theoretical distribution of Varanasi PPA data.

Table 6 represents the observed and expected distribution of PPA for the Uttar Pradesh district in Gazipur, NFHS-5. In this table, there are a total 262 number of cases in Gazipur, and the class intervals 20-40 have been merged because the expected frequency of 20-25, 25-30, 30-35, and 35-40 cells were less than 5. So, the revised class interval would be 0-5, 5-10, 10-15, 15-20, 20-40. After doing the goodness of fit test, we got the chi-square value of 7.28 at 3 degrees of freedom and at a 5% significance level, which is insignificant. Then, we can consider the exponential distribution as the theoretical distribution of the Gazipur PPA data.

Table 7 shows the observed and expected distribution of PPA of utter Pradesh of the district in Jaunpur, NFHS-5. In this table, there is a total 325 number of cases in Jaunpur, and we have

categorized the months of PPA in class intervals such as 0-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40 months in which 15-40 have been merged because the expected frequency was less than 5. So, the revised class intervals would be 0-5, 5-10, 10-15, and 15-40 months. Here, the chi-square value after testing the goodness of fit is 4.52 at 2 degrees of freedom and at a 5% significance level, which is less than the tabulated value. Therefore, the exponential distribution could be the theoretical distribution of Jaunpur PPA data.

Table 8 shows the observed and expected distribution of PPA for the Uttar Pradesh district in Bhadohi, NFHS-5. In this table, there are a total 343 number of cases in Bhadohi, and the class intervals 20-40 have been merged because the expected frequency of 20-25, 25-30, 30-35, and 35-40 cells were less than 5. So, the revised class interval would be 0-5, 5-10, 10-15, 15-20, 20-40. After doing the goodness of fit test, we got the chi-square value of 7.28 at 3 degrees of freedom and at a 5% level of significance, which is less than the calculated value. Then, we can consider the exponential distribution as the theoretical distribution of Bhadohi's PPA data.

3.1 Tables and Figures

Table 1. Percent distribution of PPA in education, caste, BMI, and wealth index for Varanasi in NFHS-5 (2019-21)

Covariates	0-5 months		5-10 months		10-15 months		15-20 months		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Education										
No education	21	8.2	3	1.2	3	1.2	0	0	27	10.5
Primary	6	2.3	9	3.5	1	0.4	0	0	16	6.2
Secondary	95	37	23	8.9	8	3.1	0	0	126	49
Higher	68	26.5	11	4.3	5	1.9	4	1.6	88	34.2
Total	190	73.9	46	17.9	17	6.6	4	1.6	257	100
Caste										
SC/ST	36	14	8	3.1	0	0.8	0	0	46	17.9
OBC	132	51.4	30	11.7	12	4.7	4	1.6	178	69.3
Others	22	8.6	8	3.1	3	1.2	0	0	33	12.8
Total	190	74	46	17.9	15	6.7	4	1.6	257	100
Body Mass Index										
Under Weight	30	10	9	3.2	0	0	0	0	39	13.3
Normal	115	46.2	23	9.2	13	4.8	4	1.6	155	61.8
Overweight	45	18.1	14	5.6	4	1.2	0	0	63	24.9
Total	190	74.3	46	18	17	6	4	1.6	257	100
Wealth Index										
Poorest	22	8.6	5	1.9	5	1.9	1	0.4	33	12.8
Poorer	37	14.4	13	5.1	2	0.8	0	0	52	20.2
Middle	39	15.2	9	3.5	4	1.6	2	0.8	54	21
Richer	36	14	4	1.6	1	0.4	1	0.4	42	16.3
Richest	56	21.8	56	5.8	5	1.9	0	0	76	29.7
Total	190	73.9	46	17.9	17	6.6	4	1.6	257	100

Table 2. Percent distribution of PPA in education, caste, BMI, and wealth index for Ghazipur in NFHS-5 (2019-21)

Covariates	0-5 months		5-10 months		10-15 months		15-20 months		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Education										
No education	29	10.3	2	0.7	5	1.8	0		0	36
	12.8									
Primary	16	5.7	4	1.4	0	0	0	0	20	7.1
Secondary	91	38.3	27	9.6	7	2.5	1	0.4	126	50.7
Higher	66	24.1	12	4.3	3	1.1	0		0	81
	29.4									
Total	202	78.4	45	16	15	5.3	1	0.4	263	100
Caste										
SC/ST	72	25.5	16	5.7	4	1.4	1	0.4	93	33
OBC	115	47.5	25	8.9	11	3.9	0	0	151	60.3
Others	15	5.3	4	1.4	0	0	0	0	19	6.7
Total	202	78.4	45	16	15	5.3	1	0.4	263	100
Body Mass Index										
Under Weight	36	11.9	7	2.2	5	1.8	0	0	48	15.8
Normal	137	56.1	34	12.2	8	2.9	1	0.4	180	71.6
Overweight	29	10.4	4	1.4	2	0.7	0	0	35	12.6
Total	202	78.4	45	15.8	15	5.4	1	0.4	263	100
Wealth Index										
Poorest	60	23.4	13	4.6	7	2.5	1	0.4	81	30.9
Poorer	56	21.6	15	5.3	7	2.5	0	0	78	29.4
Middle	50	19.9	5	1.8	0	0	0	0	55	21.6
Richer	25	9.6	8	2.8	1	0.4	0	0	34	12.8
Richest	11	3.9	4	1.4	0	0	0	0	15	5.3
Total	202	78.4	45	16	15	5.3	1	0.4	263	100

Table 3. Percent distribution of PPA in education, caste, BMI, and wealth index for Jaunpur in NFHS-5 (2019-21)

Covariates	0-5 months		5-10 months		10-15 months		15-20 months		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Education										
No education	28	8.60	8	2.50	2	0.60	1	0.30	39	12.00
Primary	17	5.20	4	1.20	0	0.00	0	0.00	21	6.50
Secondary	142	43.70	30	9.20	3	0.90	1	0.30	176	54.20
Higher	78	24.00	10	3.10	1	0.30	0	0.00	89	27.40
Total	265	81.50	52	16.00	6	1.80	2	0.60	325	100.00
Caste										
SC/ST	73	22.50	14	4.30	1	0.30	1	0.30	88	27.20
OBC	164	50.60	32	9.90	4	1.20	1	0.30	202	62.30
Others	27	8.30	6	1.90	1	0.30	0	0.00	34	10.50
Total	264	81.50	52	16.00	6	1.90	2	0.60	325	100
Body Mass Index										
Under Weight	30	9.60	9	2.90	0	0.00	1	0.30	40	12.90
Normal	200	64.10	35	11.30	3	1.00	1	0.60	239	72.60
Overweight	37	11.90	7	2.30	2	0.60	0	0.00	46	14.80
Total	267	81.40	51	16.40	5	1.60	2	0.60	325	100
Wealth Index										
Poorest	30	9.20	8	2.50	0	0.00	1	0.30	39	12.00
Poorer	96	29.50	16	4.90	2	0.60	1	0.30	115	35.40
Middle	68	20.90	16	4.90	1	0.30	0	0.00	85	26.20
Richer	49	15.10	7	2.20	1	0.30	0	0.00	57	17.50
Richest	22	6.80	5	1.50	2	0.60	0	0.00	29	8.90
Total	265	81.50	52	16.00	6	1.80	2	0.60	325	100

Table 4. Percent distribution of PPA in education, caste, BMI, and wealth index for Bhadohi in NFHS-5 (2019-21)

Covariates	0-5 months		5-10 months		10-15 months		15-20 months		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Education										
No education	49	14.30	12	3.50	9	2.60	1	0.30	71	20.70
Primary	23	6.70	5	1.50	2	0.60	1	0.30	31	9.00
Secondary	110	32.10	31	9.00	9	2.60	1	0.30	151	44.00
Higher	57	16.60	32	9.30	1	0.30	0	0.00	90	26.20
Total	239	69.70	80	23.30	21	6.10	3	0.90	343	100.00
Caste										
SC/ST	55	16.10	19	5.60	11	3.20	1	0.30	85	24.90
OBC	152	44.40	47	13.70	9	2.60	2	0.60	210	61.40
Others	31	9.10	14	4.10	1	0.30	1	0.30	47	13.70
Total	238	69.60	80	23.40	21	6.10	4	1.20	343	100.00
Body Mass Index										
Under Weight	25	7.80	10	3.10	3	0.90	10	3.10	48	11.80
Normal	141	43.90	50	15.60	12	3.70	5	1.50	208	63.20
Overweight	62	19.30	19	5.60	2	0.60	4	1.20	87	24.90
Total	228	71.00	75	23.40	17	5.30	5	1.50	343	100.00
Wealth Index										
Poorest	56	16.30	22	6.40	9	2.60	0	0.00	87	25.40
Poorer	73	21.30	17	5.00	8	2.30	2	0.60	100	29.20
Middle	52	15.20	25	7.30	3	0.90	1	0.30	81	23.60
Richer	37	10.80	9	2.60	1	0.30	0	0.00	47	13.70
Richest	21	6.10	7	2.00	0	0.00	0	0.00	28	8.20
Total	239	69.70	80	23.30	21	6.10	3	0.90	343	100.00

Table 5. Observed and Expected distribution of PPA for Uttar Pradesh of the district in Varanasi, NFHS-5 (2019- 21)

PPA in months	Observed Frequency	Expected Frequency	Chi-Square value
0-5	190	176.878	0.973
5-10	46	55.142	1.515
10-15	17	17.191	0.002
15-20	4	5.359	0.344
20-25	0	2.404	2.404
25-30			
30-35			
35-40			
Total	**257**		$\chi^2_{Cal}(3) = 5.24$ $\chi^2_{tab}(3) = 7.81$

$\bar{X}$ = 4.28, Estimate of θ = 0.23

Table 6. Observed and Expected distribution of PPA for Uttar Pradesh of district in Ghazipur, NFHS-5 (2019-21)

PPA in months	Observed Frequency	Expected Frequency	Chi-Square value
0-5	190	174.861	1.310694
5-10	44	55.1573	3.446328
10-15	23	19.34263	0.691549
15-20	3	6.433196	1.832189
20-25	3	3.166646	0.00877
25-30			
30-35			
35-40			
Total	**262**		$\chi^2_{Cal}(3) = 7.28$ $\chi^2_{tab}(3) = 7.81$

$\bar{X}$ = 4.54, Estimate of θ =0.22

Table 7. Observed and Expected distribution of PPA for Uttar Pradesh of district in Jaunpur, NFHS-5 (2019-21)

PPA in months	Observed Frequency	Expected Frequency	Chi-Square value
0-5	251	244.2014	0.1892
5-10	63	60.7112	0.0862
10-15	9	15.09348	2.4600
15-20	2	4.9892	1.7909
20-25			
25-30			
30-35			
35-40			
Total	**325**		$\chi^2_{Cal}(2) = 4.52$ $\chi^2_{tab}(2) =$**5.99**

$\bar{X}$ = 3.85, Estimate of θ =0.25

Table 8. Observed and Expected distribution of PPA for Uttar Pradesh of district in Bhadohi, NFHS-5 (2019-21)

PPA in months	Observed Frequency	Expected Frequency	Chi-Square value
0-5	224	231.3934	0.2362
5-10	88	75.2916	2.1450
10-15	26	24.4986	0.0920
15-20	2	7.9714	4.4732
20-25	3	3.8017	0.1690
25-30			
30-35			
35-40			
Total	**343**		$\chi^2_{Cal}(3) = 7.11$ $\chi^2_{tab}(3) = 7.81$

$\bar{X}$ = 4.80, Estimate of θ =0.20

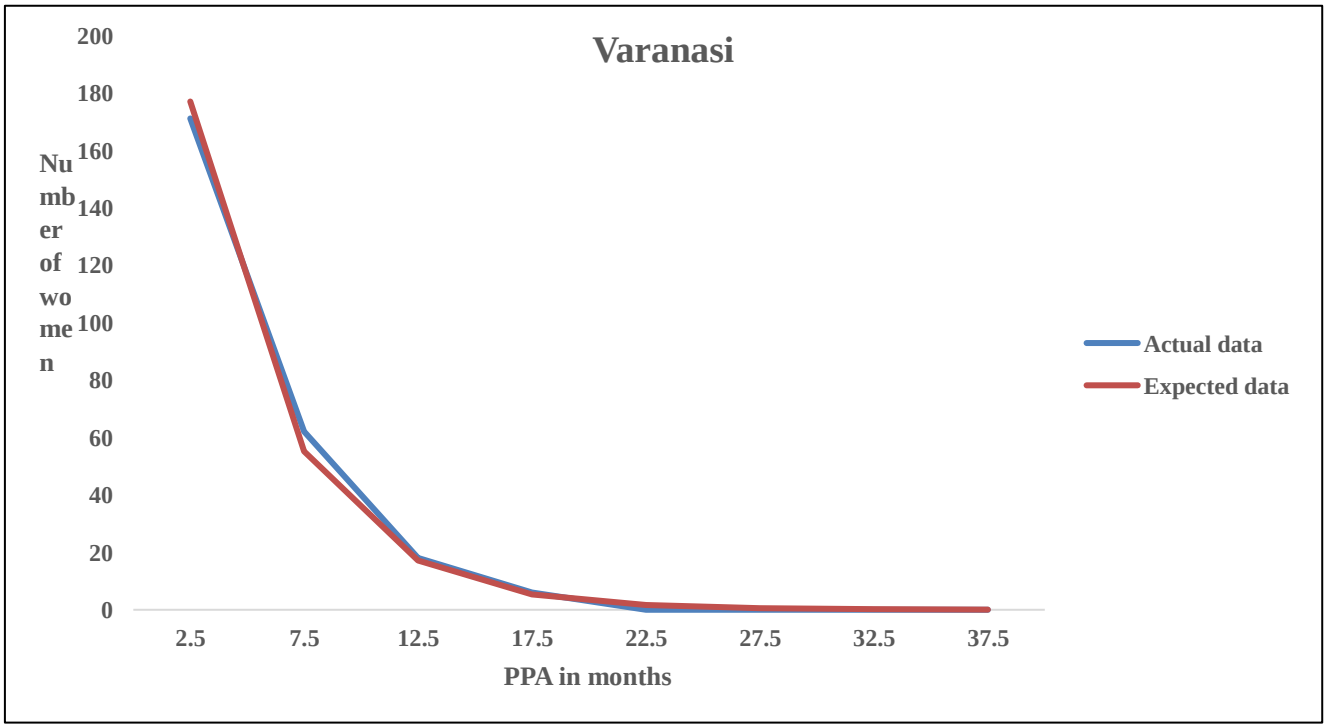

Figure 1. Observed results and Expected results for Varanasi.

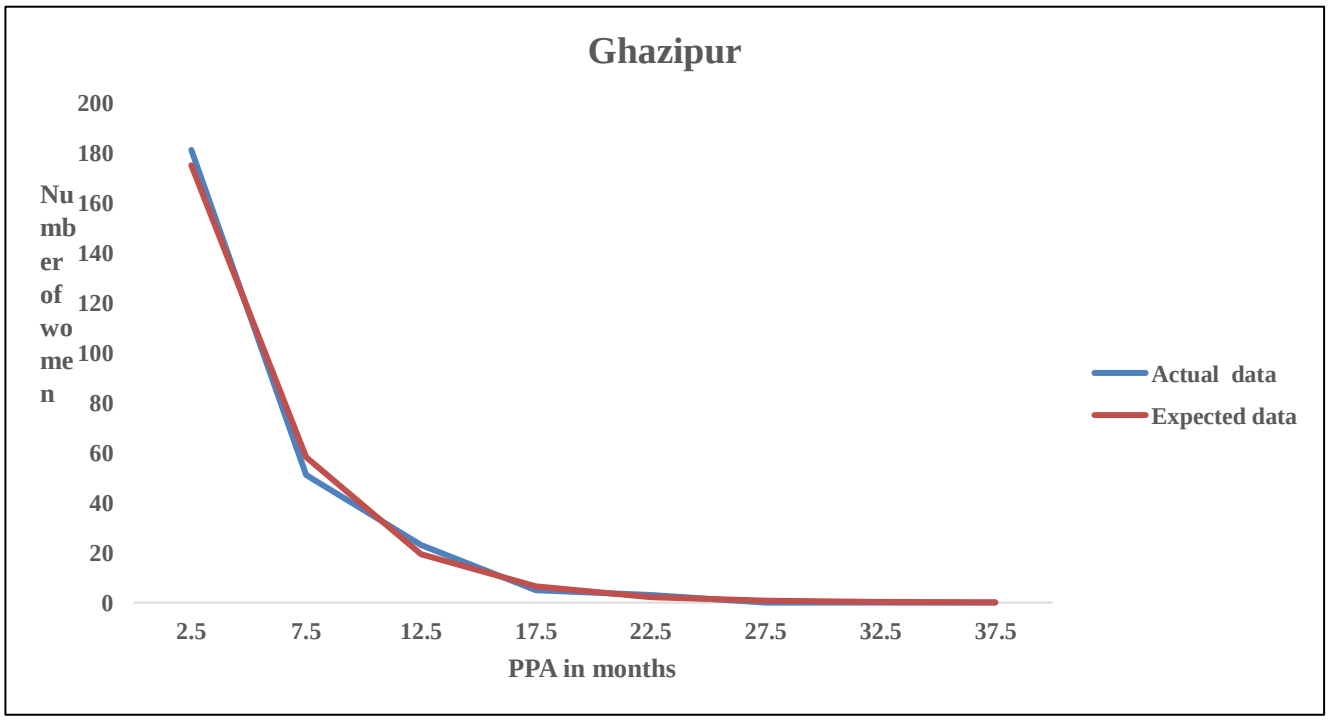

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Figure 2. Observed results and Expected results for Gazipur

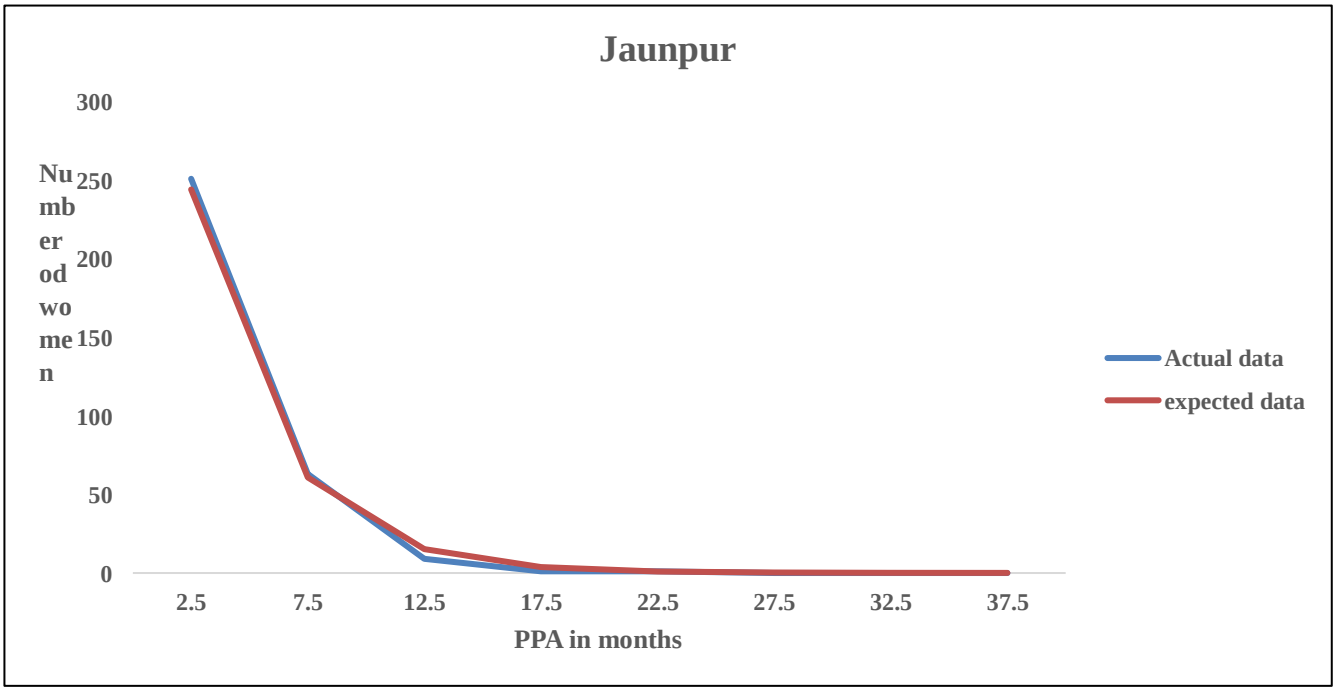

Figure 3. Observed results and expected results for Jaunpur.

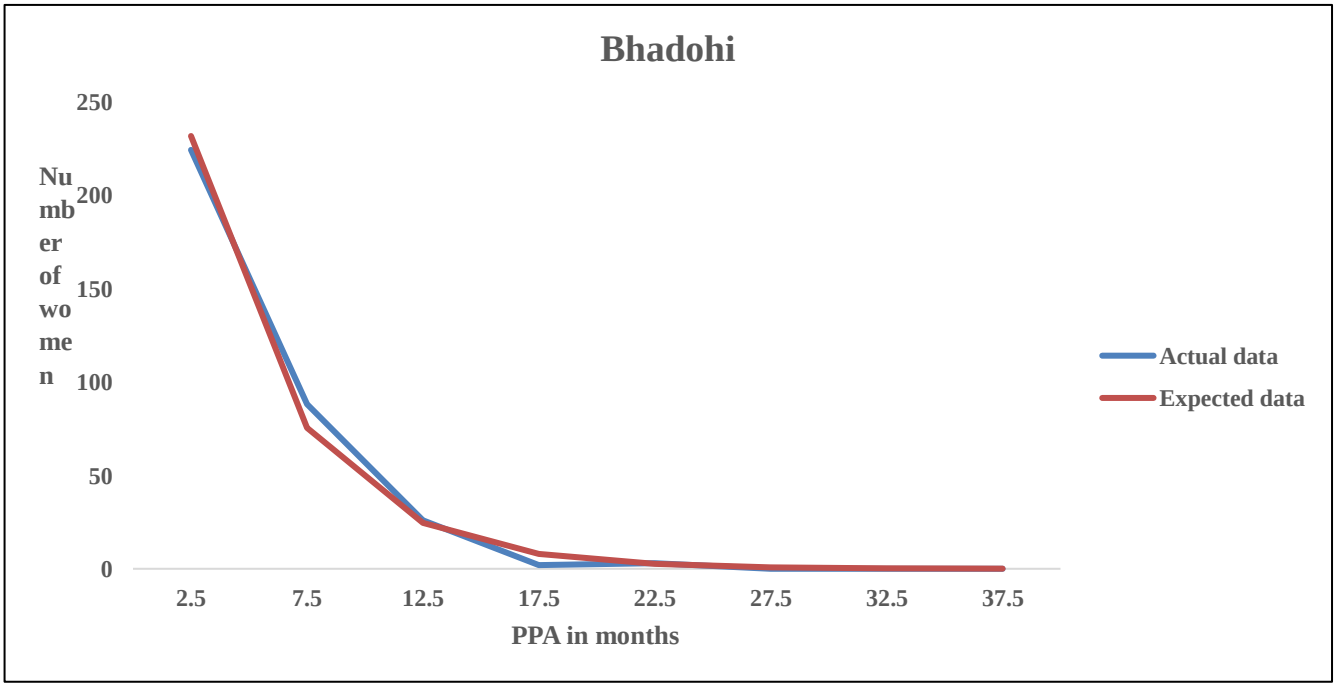

Figure 4. Observed results and expected results for Bhadohi.

4. Conclusions

Based on the analysis, we can see that the results are similar for all four districts of Uttar Pradesh. Asper NFHS-5 data, the average duration of PPA is five months, and most women have completed their secondary education in all four districts. The BMI was found to be normal in all four districts of Uttar Pradesh. Richer and richest women of Varanasi participate in PPA because more than 45% of the population is urban, but the majority of poorest to middle-class women have participated in PPA from Ghazipur. The poorer to richer women of Jaunpur have participated in PPA, and the poorest and middle-class women participated in PPA from Bhadohi. We found that exponential distribution is the theoretical distribution for PPA data of selected districts of Uttar Pradesh.

5. Limitations

This study applies only to four districts of Uttar Pradesh not to the entire state or nation because there are differences among the variables. We have tried to estimate a reliable and valid result, but the data we took from NFHS-5 is cross-sectional and could be biased for sensitive and personal information.

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Conflicts of Interest

The authors declare no conflict of interest.

Author Contributions

Conceptualization: MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Data curation:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Formal analysis:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Funding acquisition:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Investigation:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Methodology:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Project administration:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Software:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Resources:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Supervision:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Validation:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Visualization:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Writing - original draft:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R. **Writing - review and editing:** MAURYA, R.K.; PANT, R.; KUMAR, A.; SONI, R.

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