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RESEARCH ARTICLE

Identification of Factors Influencing the Total Number of Living Children of Women in the Reproductive Period (15–49 Years) with Reference to NFHS-5 Data Specific to Uttar Pradesh

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Abstract

Fertility patterns play a pivotal role in determining population growth and maternal health outcomes. Uttar Pradesh, India's most populous state, continues to experience fertility levels exceeding the national average, with a total fertility rate (TFR) of 2.4 compared to 2.0 at the national level. The present study aims to analyze the determinants of the total number of living children among women aged 15–49 years, utilizing data from 93,124 participants in the National Family Health Survey-5 (2019–2021). A cross-sectional analytical design was applied, and associations between fertility and twelve socio-demographic factors were assessed using chi-square tests of independence. The results showed statistically significant associations between all examined variables and fertility levels ($p < 0.001$). Among these, age group showed the strongest association, followed by educational attainment and contraceptive use. Women residing in rural areas, with lower education, lower wealth status, and non-use of contraception, were found to have higher fertility levels. The findings underscore the critical importance of strengthening female education, expanding access to contraceptive services, and implementing targeted rural

reproductive health programs. An integrated approach that simultaneously promotes education, economic empowerment, and reproductive health accessibility is essential for advancing fertility decline and supporting sustainable demographic transition in Uttar Pradesh.

Keywords: Fertility, reproductive health, socio-demographic factors, Uttar Pradesh, NFHS-5 data, chi-square test of association.

1. Introduction

1.1 Background

Fertility is defined as the actual number of children born to a woman or population, is one of the most critical demographic variables affecting population growth, structure, and health outcomes. The total fertility rate (TFR)—the average number of children a woman would have in her lifetime—serves as a key indicator of development and population health status.

India has experienced substantial demographic transition over the past seven decades. The national TFR declined from 5.9 children per woman in 1951 to 2.0 in 2019-2021 (NFHS-5), representing significant progress toward population stabilization. However, these national average masks considerable interstate variation. While southern states like Tamil Nadu and Kerala have achieved TFRs below 2.0 and even experienced slight increases in recent years, several northern states, particularly Uttar Pradesh, Bihar, and Meghalaya, continue to exhibit substantially higher fertility rates, with only five states in India maintaining TFRs above the replacement level of 2.1.

Uttar Pradesh presents a unique demographic context requiring focused analysis. As India's most populous state with approximately 220 million inhabitants (16.5% of India's total population), UP's demographic trajectory profoundly influences national population projections and development outcomes. The state exhibits a TFR of 2.4, which is 20% higher than the national average. Given the compounding effect of this higher fertility rate across a large population base, UP accounts for a disproportionate share of India's population growth. Furthermore, within UP itself, substantial inter-district variation exists, with TFRs documented to range from 1.6 in highly urbanized Lucknow district to over 4.0 in rural Tarai districts bordering Nepal. The continuation of above-replacement fertility in UP reflects complex interactions of socioeconomic, educational, cultural, and programmatic factors. Recent analysis of NFHS-5 data shows that UP's fertility remains substantially higher than other states despite improvements in institutional delivery rates (83.4% in NFHS-5 compared to 67.8% in NFHS-4), suggesting that fertility reduction pathways extend beyond maternal health service delivery to encompass education, contraceptive access, and economic opportunity.

1.2 Problem Statement

Despite significant national progress in fertility reduction, Uttar Pradesh continues to face challenges in achieving demographic transition. The state's relatively high fertility, combined with rapid population growth, places enormous pressure on educational systems,

healthcare infrastructure, employment opportunities, and environmental resources. Higher fertility is also associated with reduced maternal health outcomes, lower female education and workforce participation, increased childhood malnutrition, and reduced intergenerational health investments. While contraceptive prevalence has increased in UP from 54% (NFHS-4) to 67% (NFHS-5) at the national level overall, substantial work remains, particularly in addressing rural-urban disparities and ensuring method diversity. The unmet need for family planning in UP remains at approximately 9-13%, indicating that substantial proportions of women desire to space or limit childbearing but lack access to or knowledge of effective family planning methods.

1.3 Research Objectives

Primary Objective: To identify and analyze factors influencing the total number of living children among women aged 15-49 years in Uttar Pradesh using NFHS-5 data.

Specific Objectives:

1. To describe the socio-demographic characteristics of reproductive-age women in Uttar Pradesh.
2. To examine associations between total number of living children and socio-demographic variables using chi-square tests.
3. To identify the relative strength of associations between fertility and different factors.
4. To provide evidence-based recommendations for fertility reduction and reproductive health improvement informed by empirical findings.

1.4 Significance of the Study

This study addresses an important gap in current knowledge regarding fertility determinants in India's most populous state. By utilizing nationally representative data and favourable statistical analysis, this research provides evidence-based insights for policymakers and program planners. Understanding which factors most strongly influence fertility enables more efficient allocation of limited resources toward high-impact interventions. The findings will inform design and implementation of reproductive health programs, educational policies, and economic development initiatives in Uttar Pradesh and have potential relevance for other states with similar demographic profiles and development challenges.

Literature Review:

2.1 Fertility Decline and Demographic Transition

Fertility decline represents one of the most significant demographic phenomena of the modern era. The process of demographic transition the shift from high mortality and high fertility to low mortality and low fertility has reshaped population structure and growth rates globally. In India, this transition has been substantial but geographically uneven. Notestein's foundational work conceptualized fertility transition as driven by socioeconomic modernization, while subsequent research has identified education, contraceptive availability, changing gender roles, and women's empowerment as critical mechanisms. The national TFR declined from 5.9 in 1951 to 2.0 in 2019-2021, primarily driven by increased

contraceptive prevalence, delayed marriage and childbearing, increased female education, and improved economic development. However, significant interstate heterogeneity persists, with southern states having achieved fertility well below replacement level while several northern states including Uttar Pradesh, Bihar, and Rajasthan maintain above-replacement fertility. This geographic variation reflects differing levels of development, education, and infrastructure across states, with districts in northern India showing fertility patterns more characteristic of earlier stages of demographic transition than southern counterparts.

2.2 Educational Attainment and Fertility

Among all socio-demographic factors, female education emerges as perhaps the strongest and most consistent predictor of fertility across diverse populations globally. Recent analysis of NFHS data reveals that improvements in women's education contributed 39% to the reduction in TFR between NFHS-1 (1992-93) and NFHS-4 (2015-16), with education becoming an increasingly important driver of fertility decline. Educational attainment influences fertility through multiple well-documented mechanisms. First, education delays marriage and childbearing, reducing the years of exposure to pregnancy risk. Women with secondary or higher education marry on average 4-6 years later than uneducated women. Second, education increases economic opportunities and earning potential, enhancing the opportunity cost of childbearing and incentivizing investment in child quality rather than quantity. Third, education improves knowledge of contraceptive methods and health issues, with literate women demonstrating 2-3 times higher knowledge of modern contraceptive methods compared to illiterate women. Fourth, education enhances women's household decision-making authority and reproductive autonomy, enabling translation of fertility preferences into contraceptive practice. Finally, education facilitates exposure to information and values supporting smaller family norms. Research on education-fertility relationships in India specifically demonstrates that while basic primary education has limited fertility effects, secondary education acts as a critical threshold, with steep fertility decline occurring when women have 7 or more years of education. In Uttar Pradesh, the educational gap in fertility is particularly pronounced, with mean years of education explaining substantial portions of district-level fertility variation. Women with 12 or more years of education average 1.1-1.3 fewer children than uneducated women, demonstrating the powerful effect of education on completed family size.

2.3 Age and Fertility

Age fundamentally constrains fertility through biological mechanisms. Women's reproductive capacity is limited to the period between menarche (typically 12-15 years) and menopause (typically 45-50 years). The relationship between age and cumulative fertility is well-established: younger women early in their reproductive careers have had less time to accumulate births, while older women nearing menopause have had maximum exposure to pregnancy risk. In cross-sectional data, age represents the single strongest determinant of fertility, with necessary biological constraints explaining >85% of fertility variation across age groups. Mean age at first birth emerges as a particularly important indicator in fertility transition. Increases in age at first birth are consistently associated with declining total fertility rates, as delaying first births extends birth spacing and reduces completed family size. The mean age at first birth of 20.74 years documented in this Uttar Pradesh sample reflects

relatively early childbearing compared to southern states but shows variation by education and urban-rural residence. Strategies that delay first birth even by 2-3 years have been documented to reduce completed family size by 0.5-1.0 children.

2.4 Wealth, Socioeconomic Status, and Fertility

Economic resources and socioeconomic status consistently show inverse relationships with fertility across developing countries. Wealthier households exhibit lower fertility through multiple pathways identified in recent research. As living standards rise, children transition from being economic assets (contributing household labor in agricultural settings) to being economic investments with high per-child costs for education, healthcare, and living standards. Wealthier households have better access to educational opportunities, reproductive health services, and employment alternatives for women, each of which independently influences fertility. Additionally, formal social insurance and savings mechanisms available to wealthier households reduce reliance on large families as economic security mechanisms—a particularly important consideration in settings with limited social safety nets. The Demographic and Health Surveys across multiple countries consistently document wealth-fertility gradients, with poorest wealth quintiles showing fertility 1.0-1.5 children per woman higher than richest quintiles. In India, household asset-based wealth indices show similar patterns, with lower-wealth households exhibiting substantially higher TFRs, with differential particularly pronounced in rural areas. The 49.1% of the UP sample in the lowest wealth quintile indicates that substantial poverty reduction could yield demographic benefits through expanded educational and economic opportunities.

2.5 Urban-Rural Residence and Service Delivery

Rural-urban differences in fertility represent one of the most robust demographic findings, documented across virtually all developing countries and most developed countries as well. Rural areas consistently exhibit higher fertility than urban areas through multiple interconnected mechanisms identified in recent analyses. Urban India has achieved a TFR of 1.6 (below replacement) while rural India remains at 2.1 (at replacement level), with the persistent rural-urban gap of approximately 0.5 children per woman reflecting structural differences in infrastructure, services, and economic organization. Rural areas typically have lower educational attainment, particularly for girls, reflecting both less developed educational infrastructure and higher opportunity costs of schooling. Rural healthcare and family planning services are substantially less developed than urban services, with reduced availability of modern contraceptive methods, particularly long-acting reversible methods (LARCs). Agricultural occupations create economic incentives for larger families due to labor availability and child productivity. Rural communities often maintain stronger traditional norms supporting higher fertility, with less exposure to cosmopolitan values regarding family size and women's roles. Research indicates that the rural disadvantage operates substantially through education and service access but that significant residual differences persist even after controlling for these factors.

2.6 Contraceptive Knowledge and Use

Contraceptive utilization directly influences fertility by preventing or spacing pregnancies, operating as one of the most proximate determinants of fertility. Modern

contraceptive prevalence represents perhaps the most direct policy lever for fertility reduction, with substantial epidemiological evidence that increases in contraceptive use are associated with fertility decline across all regions. Recent national data show that 67% of married women use contraception and 56% use modern methods (NFHS-5), yet substantial variation persists across education, wealth, and rural-urban strata, with contraceptive use among uneducated women (41%) substantially lower than educated women (75%). Access to diverse contraceptive methods, knowledge of available options, and acceptability of contraception are critical determinants of whether women can achieve their fertility preferences. In UP specifically, contraceptive prevalence has increased but remains at 60.7% among women responding to contraceptive questions, below national averages and substantially below South Indian states. The method mix in UP differs from national patterns, with greater reliance on female sterilization (38% of modern method use nationally) and lower use of long-acting reversible methods (IUDs, implants) compared to other regions. The Mission Parivar Vikas Programme focused on 145 high-fertility districts in seven states (including UP) emphasizes increasing contraceptive access and diversity to improve fertility outcomes.

2.7 Reproductive Health Knowledge and Literacy

Knowledge of reproductive physiology, including understanding of the ovulatory cycle and fertile period, represents a dimension of reproductive health literacy. Women with reproductive knowledge are better positioned to plan pregnancies and make informed contraceptive choices. Knowledge alone is insufficient for fertility control but is necessary for informed reproductive decision-making. The high prevalence of ovulatory cycle knowledge documented in this sample (92.7%) suggests substantial reach of reproductive health messaging, yet the incomplete translation of knowledge into contraceptive practice (39.3% have never used any method) indicates that knowledge must be coupled with access to services, economic resources, motivation, and partner support.

Methodology:

3.1 Data Source

This study utilizes data from the National Family Health Survey-5 (NFHS-5), conducted in India during 2019-2021. National Family Health Survey (NFHS) is a large scale nationally representative cross-sectional survey conducted in India by International Institute of Population Sciences (IIPS), Mumbai under the stewardship of the Ministry of Health and Family Welfare (MoHFW), Government of India. NFHS collects data of all individual ever-married women aged 15 to 49 years in the household using personal interviews by trained interviewers and a well-designed questionnaire in India. NFHS-5 represents the most recent nationally representative household survey providing comprehensive data on reproductive health, family planning, population, and maternal and child health characteristics. NFHS-5 maintains the rigorous scientific standards established in previous NFHS rounds (NFHS-1 through 4) conducted since 1992-93.

NFHS-5 employed a stratified multistage cluster sampling design to ensure national representativeness. The survey covered all states and union territories of India. In Uttar Pradesh, the survey was conducted across all 75 districts. The survey questionnaire collected

comprehensive information on demographics, reproductive history, contraceptive use, fertility preferences, maternal and child health, and other relevant characteristics through standardized instruments developed through extensive qualitative research and cognitive testing. Dataset is available to the public online.

3.2 Study Population and Sample

The study population comprises all women aged 15-49 years (standard reproductive age group as defined by the United Nations) who were interviewed in NFHS-5 and reported residing in Uttar Pradesh. The analytical sample includes 93,124 women.

3.3 Variables Included

Dependent Variable:

- **Total number of living children:** The count of living children born to each respondent at the time of survey, representing actual completed or near-completed fertility outcomes for older women and ongoing fertility accumulation for younger women. In NFHS 5 data variable Number of Living Children ranges from 0 to 11 and for this study the outcome variable was categorized into 4 categories as: 0,1,2,3,>=4 Living Children and for simplicity we have coded them as 0,1,2,3 and 4.

Independent Variables: A set of categorical explanatory variables were considered as independent variables namely:

1. **Age-group:** Categorical variable with four categories (15-24, 25-34, 35-44, 45-49 years) representing distinct reproductive life stages with different cumulative fertility exposure.
2. **Place of residence:** Categorical variable with two categories (Urban and Rural).
3. **Religion:** Categorical variable with three categories including Hindu, Muslim, and other religions.
4. **Educational level:** Ordinal variable with four categories (no education, primary, secondary and higher education).
5. **Wealth index:** Ordinal variable with four categories (Lower Middle, Middle, Upper Middle and Richest).
6. **Knowledge of ovulatory cycle:** Binary variable indicating whether respondent knows the fertile period in menstrual cycle (Yes, No).
7. **Ever had terminated pregnancy:** Binary variable capturing reproductive history of pregnancy loss (Yes, No).
8. **Alcohol consumption:** Binary variable regarding alcohol use (Yes, No).
9. **Cigarette smoking:** Binary variable regarding smoking (Yes, No).
10. **Employment status:** Binary variable indicating current work participation in paid employment (Yes, No).
11. **Ever used contraception:** Binary variable measuring any past use of methods to avoid or delay pregnancy (Yes, No).

12. **Sex of household head:** Binary variable distinguishing male-headed and female-headed households (Yes, No).

3.4 Statistical Analysis

Descriptive Analysis: Descriptive statistics were calculated for all variables. For continuous variables (age at first birth, age at menarche), means and standard deviations were computed. For categorical variables, frequency distributions and percentages were calculated, providing comprehensive characterization of the study population.

Association Analysis: Chi-square tests of independence were used to examine the associations between total number of living children and each socio-demographic variable. The chi-square test determines whether observed frequencies in a contingency table differ significantly from frequencies expected under the null hypothesis of independence. This approach enables systematic assessment of each factor's association with fertility while acknowledging that cross-sectional data cannot establish causality.

The chi-square statistic is calculated as:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

where O represents observed frequencies and E represents expected frequencies under independence. Under the null hypothesis of independence, the chi-square statistic follows a chi-square distribution with degrees of freedom equal to (r-1) (c-1), where r represents number of rows and c represents number of columns.

Statistical significance was assessed at $\alpha = 0.05$. p-values less than 0.05 were considered statistically significant. Given the large sample size (N = 93,124), substantial power exists to detect even small associations. Chi-square values themselves, beyond statistical significance, indicate association strength, with larger values indicating stronger relationships between variables.

3.5 Data Quality and Ethical Considerations

NFHS-5 was conducted following rigorous quality assurance procedures and ethical guidelines. The survey obtained appropriate institutional ethical approvals from the IIPS ethics committee and international partners. Informed consent was obtained from all participants prior to interview administration. This analysis utilizes publicly available, fully de-identified data; no individual-level identifying information is accessible. The anonymized nature of NFHS-5 public datasets removes any possibility of identifying individual respondents. Therefore, no additional ethical approval was required for this secondary data analysis, consistent with standard practices for secondary analysis of de-identified data in academic research.

Result

4.1 Descriptive Characteristics of the Sample

4.1.1 Continuous Variables

Variable	Mean	**SD**	**N**
Age of Respondent at First Birth	20.74 Years	3.469	93,124
Age at First Monthly Period (Menarche)	13.77 Years	3.185	93,124

The mean age of respondent at first birth was 20.74 years (SD = 3.469), indicating that women in UP have their first child in their early twenties on average. The substantial standard deviation indicates considerable variation across the population, with some women having first births in their mid-to-late teens and others in their late twenties or early thirties. The mean age at menarche was 13.77 years (SD = 3.185), consistent with typical biological maturation in South Asian populations and reflecting improvements in nutritional status compared to earlier generations.

4.1.2 Categorical Variables

Variable	Category	Number	Frequency (%)
Age-Group	15-24	37172	39.9
	25-34	26548	28.5
	35-44	20048	21.5
	45-49	9356	10.0
Place of Residence	Urban	18051	19.4
	Rural	75073	80.6
Religion	Hindu	77536	83.3
	Muslim	15243	16.4
	Others	345	.4
Educational Level	No Education	27249	29.3
	Primary	10542	11.3
	Secondary	41007	44.0
	Higher	14326	15.4
Wealth Index	Lower Middle	45708	49.1
	Middle	17993	19.3

	Upper Middle	14915	16.0
	Richest	14508	15.6
Knowledge of Ovulatory Cycle	Yes	86355	92.7
	No	6769	7.3
Ever had a terminated Pregnancy	Yes	12520	13.4
	No	80604	86.6
Do You Drink Alcohol?	Yes	53	.1
	No	93071	99.9
Do You Smoke Cigarette	Yes	125	.1
	No	92999	99.9
Respondent Currently Working	Yes	2275	83.6
	No	11564	16.4
Ever Used Anything to Avoid or Delay Pregnancy	Yes	5897	60.7
	No	3822	39.3
Sex of Household Head	Male	78033	83.8
	Female	15091	16.2

Age-group Distribution: The sample was predominantly composed of younger women, with 68.4% aged 15-34 years, reflecting both population age structure and ongoing entry into reproductive years. The substantial proportion of younger women reflects population momentum whereby fertility decline lags behind mortality decline, creating a population with large proportions at reproductive ages.

Place of Residence: Rural dominance evident with 80.6% women, vs. 19.4% urban.

Religion: Hindus comprise majority (83.3%), Muslims 16.4%, others 0.4%. Reflects demographic composition with known fertility differentials.

Educational Level: Nearly one-third of women lack formal education, though 59.4% have secondary or higher education, indicating both substantial educational gaps and progress in female educational enrolment.

Wealth Index: Nearly half the sample belongs to the lowest wealth category, indicating substantial poverty in UP relative to some other Indian states.

Knowledge of Ovulatory Cycle: High prevalence indicates substantial reproductive health knowledge reach.

Ever Had Terminated Pregnancy: 13.4% yes, 86.6% no indicates moderate abortion history. Reflects contraceptive gaps or spacing needs.

Alcohol Consumption & Cigarette Smoking: Negligible use (0.1% yes, 99.9% no) aligns with cultural norms. Social desirability bias possible.

Currently Working: Female employment is extremely low, representing only 16.4% among those responding, reflecting limited employment opportunities and cultural constraints on women's work in many UP communities.

Ever Used Contraception: 60.7% yes, 39.3% no reveals substantial non-use. Critical barrier to fertility control.

Sex of Household Head: Male-headed dominant (83.8%), female 16.2%.

Table 1: Cross- Tabulation results between Number of Living Children and Predictors

Predictors	Number of Living Children					
		0	1	2	3	>=4
		N (%)	N (%)	N (%)	N (%)	N (%)
Age-Group	15-24	30219 (88.2%)	4310 (41.9%)	2148 (12.4%)	433 (2.9%)	62 (0.4%)
	25-34	3332 (9.7%)	4334 (42.2%)	9036 (52.1%)	6249 (42.2%)	3597 (21.9%)
	35-44	501 (1.5%)	1170 (11.4%)	4588 (26.4%)	5831 (39.3%)	7958 (48.5%)
	45-49	195 (0.6%)	464 (4.5%)	1582 (9.1%)	2311 (15.6%)	4804 (29.3%)
Place of Residence	Urban	7051 (20.6%)	2193 (21.3%)	3764 (21.7%)	2624 (17.7%)	2419 (14.7%)
	Rural	27196 (79.4%)	8085 (78.7%)	13590 (78.3%)	12200 (82.3%)	14002 (85.3%)
Religion	Hindu	27663 (80.8%)	8865 (86.3%)	15279 (88.0%)	12761 (86.1%)	12968 (79.0%)
	Muslim	6452 (18.8%)	1364 (13.3%)	1992 (11.5%)	2017 (13.6)	3418 (20.8%)
	Others	132 (0.4%)	49 (0.5%)	83 (0.5%)	46 (0.3%)	35 (0.2%)
Educational Level	No Education	2920 (8.5%)	2028 (19.7%)	4499 (25.9%)	6605 (44.6%)	11197 (68.2%)
	Primary	2795 (8.2%)	1009 (9.8%)	2046 (11.8%)	2367 (16.0%)	2325 (14.2%)
	Secondary	21121 (61.7%)	4572 (44.5%)	7673 (44.2%)	4958 (33.4%)	2683 (16.3%)
	Higher	7411 (21.6%)	2669 (26.0%)	3136 (18.1%)	894 (6.0%)	216 (1.3%)
Wealth Index	Lower Middle	16264 (47.5%)	4302 (41.9%)	7200 (41.5%)	7687 (51.9%)	10255 (62.5%)
	Middle	6835 (20.0%)	2020 (19.7%)	3275 (18.9%)	2929 (19.8%)	2934 (17.9%)
	Upper Middle	5714 (16.7%)	1807 (17.6%)	3199 (18.4%)	2261 (15.3%)	1934 (11.8%)
	Richest	5434 (15.9%)	2149 (20.9%)	3680(21.2%)	1947 (13.1%)	1298 (7.9%)

Knowledge of Ovulatory Cycle	Yes	28597 (83.5%)	10100 (98.3%)	17050 (98.2%)	14551 (98.2%)	16057 (97.8%)
	No	5650 (16.5%)	178 (1.7%)	304 (1.8%)	273 (1.8%)	364 (2.2%)
Ever had a Terminated Pregnancy	Yes	941 (2.7%)	1823 (17.7%)	3559 (20.5%)	3081 (20.8%)	3116 (19.0%)
	No	33306 (97.3%)	8455 (82.3%)	13795 (79.5%)	11743 (79.2%)	13305 (81.0%)
Do You Drink Alcohol?	Yes	6 (0.0%)	6 (0.1%)	8 (0.0%)	9 (0.1%)	24 (0.1%)
	No	34241 (100.0%)	10272 (99.9%)	17346 (100.0%)	14815 (99.9%)	16397 (99.9%)
Do You Smoke Cigarette?	Yes	32 (0.1%)	9 (0.1%)	34 (0.2%)	21 (0.1%)	29 (0.2%)
	No	34215 (99.9%)	10269 (99.9%)	17320 (99.8%)	14803 (99.9%)	16392 (99.8%)
Respondent Currently Working	Yes	726 (14.3%)	176 (11.2%)	382 (14.9)	399 (18.7%)	592 (23.6%)
	No	4348 (85.7%)	1389 (88.8%)	2181 (85.1%)	1732 (81.3%)	1914 (76.4%)
Ever Used Anything to Avoid or Delay Pregnancy	Yes	440 (11.7%)	745 (81.3%)	1716 (93.7%)	1390 (93.8%)	1606 (92.4%)
	No	3312 (88.3%)	171 (18.7%)	115 (6.3%)	92 (6.2%)	132 (7.6%)
Sex of Household Head	Male	28548 (83.4%)	8703 (84.7%)	14761 (85.1%)	12327 (83.2%)	13694 (83.4)
	Female	5699 (16.6%)	1575 (15.3%)	2593 (14.9%)	2497 (16.8%)	2727 (16.6%

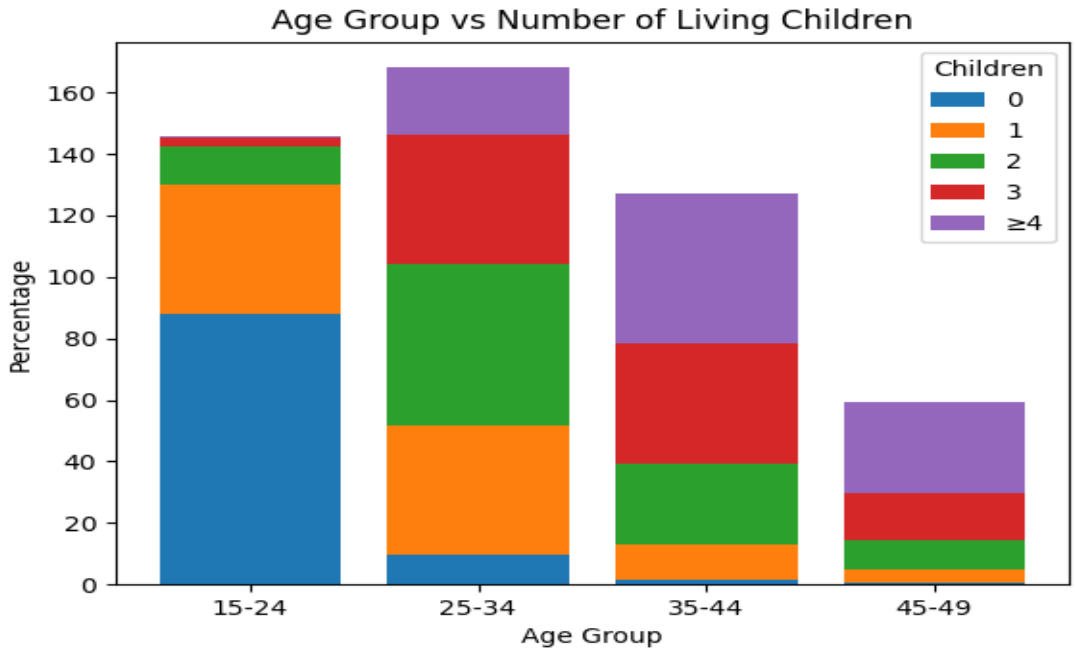

Figure 1

The chart (figure 1) shows that younger women (15–24) mostly have no children, while the number of children increases steadily with age. Older age groups (35–49) have a higher proportion of women with three or more children, indicating cumulative fertility over time.

4.2 Associations Between Total Number of Living Children and Socio Demographic Variables

Chi-square tests were performed to examine associations between total number of living children and each variable. Results are presented in Table 2.

Table 2: Chi-Square Test Results for Associations with Total Number of Living Children

Variable	χ^2 Value	p-value	Significance
Age-Group	69,043.726	0.000	Highly Significant
Educational Level	26,145.615	0.000	Highly Significant
Knowledge of Ovulatory Cycle	6,848.276	0.000	Highly Significant
Ever used Contraception	6,183.782	0.000	Highly Significant
Ever had Terminated Pregnancy	5,392.134	0.000	Highly Significant
Wealth Index	2,478.745	0.000	Highly Significant
Religion	864.733	<0.001	Significant
Place of Residence	370.286	<0.001	Significant
Employment Status	154.146	<0.001	Significant
Sex of Household Head	37.473	<0.001	Significant
Alcohol Consumption	32.733	<0.001	Significant
Cigarette Smoking	13.108	0.011	Significant

All examined variables demonstrated statistically significant associations with total number of living children ($p < 0.05$).

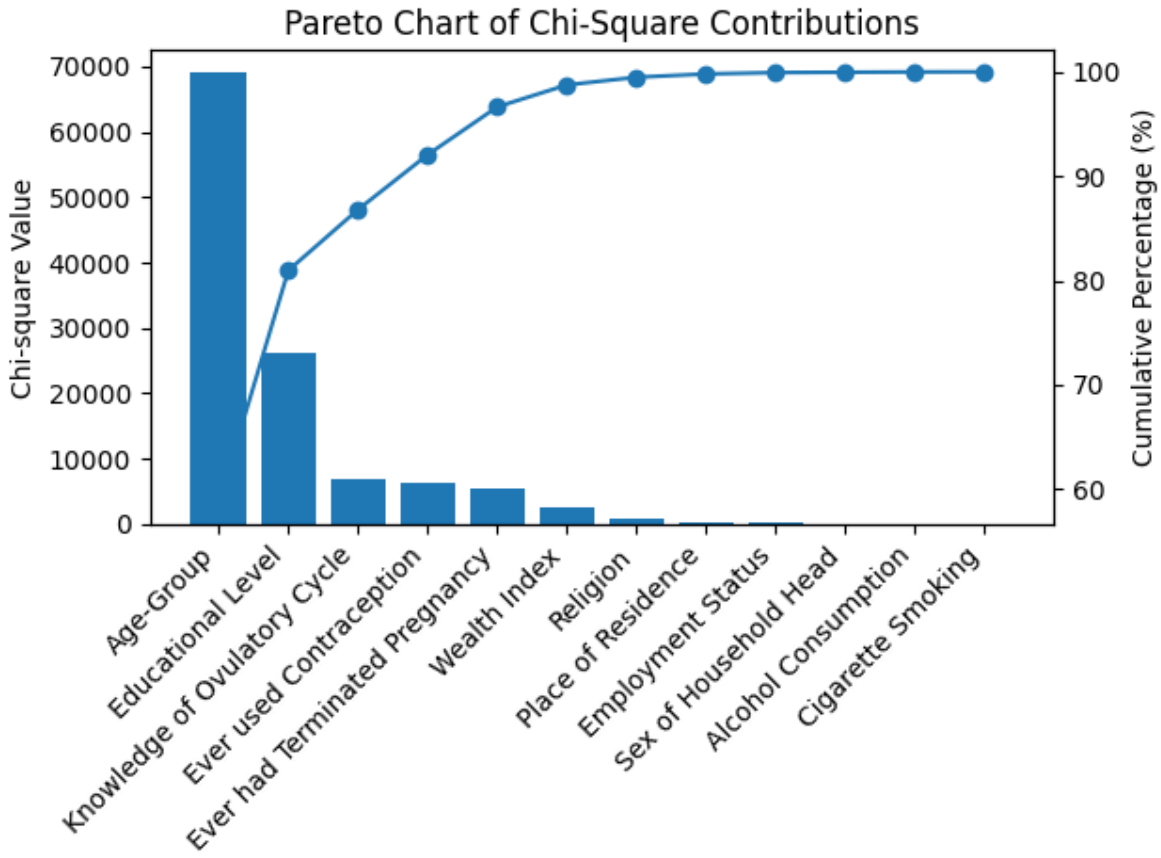

Figure 2

Most of the relationship with the number of living children is explained by age and education, as they contribute the largest share of the chi-square values. The remaining factors also show significant relationships, but their influence is much smaller in comparison.

Interpretation of major findings

5.1 Findings

- **Age-group (χ^2 = 69,043.723, p < 0.001):** Represents the fundamental biological determinant of fertility, with the exceptionally strong chi-square value (69,043.723) confirming that cumulative fertility increases necessarily with reproductive life exposure. While age cannot be modified through intervention, understanding age-specific fertility patterns enables targeted programming for younger women, particularly adolescent sexual and reproductive health initiatives.
- **Educational Level (χ^2 = 26,145.615, p < 0.001):** Among modifiable factors, educational attainment emerges as the strongest predictor of fertility (χ^2 = 26,145.615). The clear inverse relationship between education and fertility indicates that educational expansion, particularly secondary and tertiary education for girls, represents a high-impact intervention for fertility reduction. The 29.3% of reproductive-age women lacking education indicates substantial opportunity for fertility reduction through educational access expansion. Investment in female secondary education operates through multiple benefit channels including improved health literacy, delayed

marriage and childbearing, enhanced employment prospects, and increased household autonomy.

- **Ever Used Contraception (χ^2 = 6,183.782, p < 0.001):** Contraceptive utilization shows strong association with fertility confirming that family planning program effectiveness depends directly on contraceptive availability and use. The 39.3% of contraceptive-aware women who have never used any method indicates substantial opportunity for fertility reduction through expanding contraceptive access, acceptability, and method diversity. Mission Parivar Vikas Programme's focus on expanding contraceptive choice in high-fertility districts represents an important policy response.
- **Wealth Index (χ^2 = 2,478.745, p < 0.001):** Wealth and economic status significantly influence fertility, with wealthier households showing lower fertility through multiple pathways including enhanced service access and employment opportunities. This suggests that poverty reduction and economic development create favorable conditions for fertility transition through indirect effects on education and service utilization.
- **Place of Residence (χ^2 = 370.286, p < 0.001):** Substantial rural-urban differentials in fertility reflect structural differences in infrastructure, services, and economic opportunities, with rural areas showing consistently higher fertility. The 80.6% rural composition of the sample indicates that rural-specific reproductive health strategies including community-based delivery, mobile clinics, and trained health workers are critical for achieving demographic targets.
- **Knowledge of Ovulatory Cycle (χ^2 = 6,848.276, p < 0.001):** Strong association indicates that reproductive health knowledge is related to fertility outcomes. Women with knowledge of reproductive physiology demonstrate different fertility patterns, likely reflecting exposure to health messaging and greater ability to plan pregnancies and utilize contraceptive methods. The high prevalence of such knowledge (92.7% in this sample) indicates that knowledge alone, while necessary, is insufficient for fertility control absent access to services and economic resources.
- **Ever Had Terminated Pregnancy (χ^2 = 5,392.134, p < 0.001):** Strong association indicates that reproductive history is related to current fertility. Women with pregnancy termination experiences have different fertility patterns, possibly reflecting underlying fecundity issues or history of intentional birth spacing/limiting. The cross-sectional association cannot definitively disentangle mechanisms, but the significant relationship indicates reproductive history as a relevant factor.
- **Religion (χ^2 = 864.733, p < 0.001):** Significant association indicates fertility differentials across religious communities, with Muslim women showing higher fertility than Hindu women. Research suggests this reflects underlying education and socioeconomic differences across religious communities, with smaller intrinsic religious effects than gross differentials suggest.
- **Employment Status (χ^2 = 154.146, p < 0.001):** Significant association indicates that employed women have different fertility patterns than non-employed women, though the limited employment prevalence restricts this variable's population-level impact.

- **Sex of Household Head ($\chi^2 = 37.473$, $p < 0.001$):** Significant association reflects different fertility patterns in female-headed versus male-headed households, potentially reflecting differences in household composition and female autonomy.
- **Substance Use (Alcohol and Cigarette Smoking):** Both show significant but weak associations, though prevalence is extremely low in this female sample.

5.2 Policy Implications and Recommendations

Educational Investment: Given the very strong association between educational attainment and fertility, expanding access to girls' secondary and tertiary education should be a paramount policy priority. This includes removing cost barriers through scholarships and mid-day meals, addressing safety concerns limiting school attendance, ensuring teacher quality and curriculum appropriateness, and culturally sensitive approaches respecting community values while expanding girls' opportunities. Evidence indicates that secondary education for girls represents a critical threshold where fertility effects become substantial and persistent.

Family Planning Services: Strengthening reproductive health and contraceptive service delivery, particularly in rural areas, would enable translation of fertility preferences into contraceptive practice. Ensuring availability of the full range of modern contraceptive methods, increasing method diversity beyond sterilization, addressing concerns about acceptability and side effects, and involving community and religious leaders in supportive messaging are critical components of effective family planning programs.

Economic Development: Poverty reduction and economic development initiatives, particularly livelihood diversification and women's economic empowerment, create conditions supporting fertility transition. Women's access to income-generating opportunities and control over household economic resources independently influence fertility through enhanced autonomy and changing economic calculus regarding family size.

Rural-Focused Programs: Given the persistent rural disadvantage, rural-specific reproductive health strategies including strengthened primary health centers, community health worker programs, mobile health clinics, and trained birth attendants are necessary. Rural women face multiple structural barriers requiring targeted, rural-appropriate solutions rather than urban-modelled programs.

5.3 Conclusion

This comprehensive analysis of nationally representative data from the National Family Health Survey-5 reveals multiple socio-demographic factors significantly influencing fertility outcomes among women aged 15-49 years in Uttar Pradesh. Uttar Pradesh's above-national-average fertility reflects complex interactions of educational, economic, infrastructural, and programmatic factors. The statistically significant associations observed between fertility and multiple socio-demographic variables provide evidence-based guidance for policy and program priorities. Educational expansion, particularly for girls; contraceptive availability and access expansion; economic development and women's empowerment; and rural health infrastructure strengthening emerge as critical intervention points.

The persistence of high fertility in India's most populous state has national demographic implications. Improvements in UP's fertility trajectory would substantially influence national

population projections and development trajectories. Comprehensive approaches simultaneously addressing education, family planning services, economic opportunity, and rural development offer the most promising pathway toward fertility reduction and improved health outcomes in Uttar Pradesh and other high-fertility states.

The alignment of these findings with demographic transition theory, gender empowerment frameworks, and international evidence on fertility determinants provides confidence in the relevance of identified factors and their policy implications. Implementation of evidence-based policies and programs, combined with continued research identifying effective mechanisms and strategies, offers the pathway toward demographic transition toward replacement-level fertility in Uttar Pradesh.

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