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SOCIOLOGY | RESEARCH ARTICLE

A comparative analysis of reproductive measures and predictor variables among three tribes of Bilaspur, Chhattisgarh, India

Bharathi Karri[1]* and Gladis S Mathew[2]

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*Corresponding author: Bharathi Karri, Department of Anthropology, Sambalpur University, Odisha, India
E-mail: drbh249@gmail.com

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Additional information is available at the end of the article

Abstract: An attempt has been made to understand the reproductive behaviour of the Gond (146), Birhor (151) and Kawar (78) tribes of Bilaspur, Chhattisgarh. The study focuses on the role of socioeconomic and cultural factors responsible for the variation and continuum in woman's fertility and from live births to child mortality. It involves a mixed-method approach to assess the measures of fertility and mortality by using the standard formula after Barclay (1958) and Bogue (1969). Despite the child–woman ratio being high among Kawar (1857.14) followed by Birhor (833.33) and Gond (766.66), it is observed that the total fertility rate is high among Birhor (11.8) followed by Gond (9.8) and Kawar (8.5) indicating women experiencing a greater number of live births, especially among Birhor. Further, the mortality rates indicate that neonatal deaths (93.75) among the Kawar tribe, and under five mortality (148.14) among Birhor are high. This can be attributed to the influence of socioeconomic and cultural factors. It reveals that fertility is high among the study population(s) to substantiate the prenatal and postnatal loss.

ABOUT THE AUTHOR

Dr Bharathi Karri, currently working as Associate Professor in Anthropology at Sambalpur University (from June 2022), India and worked as Assistant Professor at Arba Minch University, Ethiopia (2016–2022), Guru Ghasidas Vishwavidyalaya (2013–2016), Andhra University (2012–2013). Gladis S Mathew, research scholar at Indira Gandhi National Tribal University, has worked with Dr Bharathi to collect demographic data during her tenure as postgraduate student at GGV.

The authors conducted demographic research among Kawar and Bihor, Bilaspur, Chhattisgarh, India, the finding of research reveal the problem associated during the reproductive age resulting in prenatal and postnatal mortality which is mostly neglected by the society due to their cultural beliefs and social norms. *Kawar, Birhor* (PVTGs) and *Gond* (ST) live adjacent in the same habitat. This study focuses on the demographic shifts due to fertility and mortality and the influence of predictor variables. The authors decided to study the women health on a priority basis as they need much attention in the areas of health-care promotion.

PUBLIC INTEREST STATEMENT

Changes in population size are based on births, deaths and migration. It is a well-known fact that having few children is associated with longevity. In natural fertility conditions, the number of deaths does not decrease with an increase in several children.

The present study noted that women's reproductive health worsens with an increase in the number of births to compensate for the number of child deaths. Further, it is observed that early age at marriage, age of women at first conception, and lack of appropriate health information are due to low educational level. Women can have better health choices, provided they are educated reducing the risk of child deaths. Governed bodies along with trained professionals should intensify the awareness programs that further recover the future loss.

Subjects: Anthropology - Soc Sci; Childhood - Anthropology; Health & Medical Anthropology

Keywords: Fertility; mortality; socioeconomic; cultural factors

1. Introduction

Fertility and mortality are the indicators of population growth and are essential for social and national development (Centers For Disease Control and Prevention, 2013; Population Council, 2009; Vollset et al., 2020). The reproductive performance of women is influenced by the socioeconomic status of the population (Jayathilaka et al., 2021). Socioeconomic and environmental disparities have been observed to be higher among particularly vulnerable groups than in the general population (Damodar et al., 2015; WSR, 2020). Though the country has set to achieve optimum levels of fertility and mortality by the year 2015, there exist disparities due to economy and culture among different states, regions, and ethnic groups (Gotmark & Andersson, 2020; Sahu et al., 2015). However, the timing of menarche is influenced by the interaction of genetic and environmental factors (Karapanou & Papa Dimitriou, 2010) and is identified as a risk factor for many health outcomes during adolescence and adulthood (Graber, 2013; Lee & Styne, 2013), accurate assignment of menarcheal age is critical, especially for the girls belonging to particularly vulnerable tribal groups. The age at menarche of women belonging to the age group 15–49 years is determined from a single recalled cultural event, hence the present study, considered age at menarche as one of the cultural factors. Further, these cultural factors are associated with early marriage and early conception practices which have a profound influence on the fertility and mortality levels of a woman (Alem et al., 2020; Bezie & Addisu, 2019; Bhattarai et al., 2022; Biswas & Kapoor, 2003; Gautam, 2019; Khongsdier, 2002; Maharatna, 2000; Mpilambo et al., 2017; Nanda, 2005; Paul, 2020; Shrivastava et al., 2021). Nevertheless, the probability of fertility tends to increase due to child deaths (Angko et al., 2022; Bhuyan, 1995; Grundy, 2009; Yaya et al., 2019).

Fertility rates and infant mortality rates are closely related (Bhattacharya et al., 1995; Burke, 2018; Gonzalez & Gilleskie, 2017; Winegarden & Bracy, 1995) and this association can be observed from recurring infant deaths resulting in a renewed pregnancy (Choudhury et al., 1976; Ely & Driscoll, 2021; Taylor et al., 1976; Ware, 1977). This indicates that biological, socioeconomic and cultural factors have a significant influence on the fertility (Anh et al., 1998; Bhagat & Chattopadhyay, 2004; Chaudhry, 1990; Gotmark & Andersson, 2020; Gupta, 2011; Kazembe, 2009; Mairiga et al., 2010; Nanda, 2005; Saha & Verma, 2006; P. Singh, 2002; Singh & Singh, 2012; Yaya et al., 2019) and mortality of a population (Bharathi, 2014; Cutler et al., 2006; Elizabeth et al., 2000; Kerkeni et al., 2007; Murthi et al., 1995; Rahman et al., 2008). Fertility levels are associated with mother education (Ainsworth et al., 1996; Akin, 2005; Akmam, 2002; R. Borah, 2005; Correia et al., 2014; Dev et al., 2002; Dr`eze & Murthi, 2001; Gotmark & Andersson, 2020; K.C. Borah, 2006; Kravdal, 2002; Mahanta, 2016) and low educational levels among women incapacitate to understand the consequences of early marriage and early conceptions (Arthur et al., 2018; De Groot et al., 2018; Dessalegn, 2020; Chaudhary et al., 2022; Herliana et al., 2018; Roy & Sarker, 2016; Saha et al., 2014; Yasmin et al., 2018; Yaya et al., 2019). Further, an increase in child mortality is reported due to infections, malnutrition, and poor maternal health-care facilities (Kabir et al., 2019, 2020; Kapoor et al., 2003; Solnes Miltenburg et al., 2017; Sandhu & Geethalakshmi, 2017; Sikdar, 2012).

Infant mortality rates tend to vary inversely with the level of socioeconomic development over time and space (Davanzo, 1988; Elder et al., 2016; K.K. Patel & Gouda, 2018; Woods, 1993), which may alter population health (Bicego & Boerma, 1993; Bugelli et al., 2021; Macintyre, 2010; Murray et al., 2000; B. Singh, 2007; Subramanian et al., 2006). Infant mortality rates were reported higher among the scheduled tribes and were determined by low levels of education, poverty and inaccessibility to health-care services (Busch et al., 2022; World Bank, 2007) and socio-cultural correlates (Verma, 2002). In addition, it is also reported that antenatal care among the particularly vulnerable tribal groups is not common (Pandey & Tiwari, 2001; Roy, 2017) which results in

cyclical neonatal deaths (K. K. Patel & Kumar, 2021; Khan et al., 2020; Al Kibria et al., 2018; Shah & Dwivedi, 2011). This situation further worsens in the case of the particularly vulnerable tribal groups of Chhattisgarh (Dhar, 2013). In this purview, United Nations Millennium Development Goals set a target to reduce infant mortality by the year 2015 (Lozano et al., 2011; Reddy et al., 2012; United Nations (UN), 2015) and a new initiative has been introduced by the international community agreed on a new framework, Sustainable Development Goals (SDGs) to end preventable deaths of newborn and children under 5 years of age (Liu et al., 2019; United Nations (UN), 2021; World Health Organisation, 2018). This goal is meant for all countries and aims to reduce under-five mortality to at least as low as 25 per 1000 live births for all population groups.

Child mortality conveyed high rates among populations with low socioeconomic levels than those having higher economic standards (Balaj et al., 2021; Baqui et al., 2007; Cutler et al., 2006; Rao et al., 2005) and probably the rates reported less among educated mothers than their counterparts (Das & Dey, 2003; Khasakhala, 2003; Mahumud et al., 2021). Education provides self-awareness about reproductive health and time to undergo treatment for the children (Chen et al., 2020; Desai & Alva, 1998; Deshmukh & Chaniana, 2020). Further, Chowdhury et al. (2013) reported that high birth order associated resulting in increased child mortality. Survival risk remains a key challenge for the disadvantaged who have little access to reproductive and child health services (MDGR, 2015). Still, some disadvantaged sections of society are experiencing infant and child mortality (Ranjan et al., 2018; Victoria et al., 2020). The present study intended to understand the reproductive health of Gond, Birhor and Kawar women in general and the impact of predictor variables in particular. The paper deals with the following questions;

(1) How do socioeconomic factors such as education, occupation and income play a significant role in determining the fertility level of women?

(2) How cultural factors such as age at menarche, early age at marriage and age at first conception are noteworthy in determining the mortality level of women?

2. Material and methods

The reproductive health of women is calculated by using fertility and mortality measures. These measures were assessed among Gond (ST), Birhor and Kawar (PVTGs) belonging to Umariyadadar village, Kota of Bilaspur district, Chhattisgarh. In total, there are 27 districts and 20,126 villages of which Bilaspur district has a population of 2,663,629 with 1,351,574 males (51%) and 1,312,055 females (49%) with a population growth of 33.29%. The proportion of population growth accounts for 10.43% with a sex ratio of 971 females per 1000 male population. The total population of Chhattisgarh is 2,55,40,196 with 1,28,27,915 males and 1,27,12,281 females. The sex ratio of Chhattisgarh is 991 females per 1000 males. The literacy rate among the male population is 81.45% and the female population is 60.59% (Census, 2011 Census).

Kota is a town and a nagar panchayat in Bilaspur district located at 22.3°N 82.03°E. It has an average elevation of 330 meters (1,082 feet). According to Census (2011), there are about 152 villages located in Kota of Bilaspur district, Chhattisgarh with a total of 219 families residing. Umariya Dadar is a medium-sized village with a population of 1023, of which 525 are males while 498 are females. In Umariya Dadar village, the size of 0–6 years population is about 149 children which constitute 14.57% of the total population of the village. The average sex ratio of Umariya Dadar village is 949 lower than the Chhattisgarh state average of 991. Child Sex Ratio for the Umariya Dadar as per census is 987, higher than the Chhattisgarh average of 969. Umariya Dadar village has lower literacy rate compared to Chhattisgarh. In 2011, the literacy rate of Umariya Dadar village was 66.70% compared to 70.8% in Chhattisgarh. In Umariya Dadar, male literacy stands at 79.11% while the female literacy rate was 53.54% (Census, 2011). Data collected from Gond, Kawar and Birhor tribes is based on the numerical preponderance of the people in the village with the help of a household survey.

3. Data analysis using measures of fertility

The following formulae were used for calculating fertility after Bogue (1969), Barclay (1958):

(1) **Crude Birth Rate (CBR)**: This is a ratio of "children born" and "mid-year population" in a population year and considered as "per thousand per year'.

Mathematically, CBR = B/P*K, whereas B and P represent "number of children born" and "mid-year population" in that respective year respectively, K represents constant generally it is 1000.

(2) **General Fertility Rate/Ratio (GFR)**: This is a ratio of total live-births to their mothers' number. In the present study, women who are in the child-bearing age (i.e. of child bearing age participate in the act of live-births, not the whole population).

GFR = $B/P_{(15-49)}$ * K, in which B represents the total registered live births in the year; P_{15-49}- represents the mid-year female population in the age group 15–49 years in that year; K represents constant, i.e. 1000.

(3) **Age Specific Birth Rate (ASFR)**: In this method, birth-statistics are collected with respect to the age-group of parents, which is generally divided in 2 years, 5 years, 7 years or 10 years age-interval. This is calculated with respect to the ages of women. It can be calculated with respect to the fathers' age too.

Mathematically, it is calculated by the following formula: ASBR = b*i*/p*i* * K, where, b*i* is number of births in i^{th} age interval; p*i* mid-year population of women in i^{th} age interval; K is constant = 1000. In the present study, 5 years age interval of women ages is considered.

(4) **Total Fertility Rate (TFR)**: It is the total age-specific birth-rate. It can be obtained by the summation of birth-rates at each age group throughout the child-bearing age (i.e. 15–49 years).

Mathematically, TFR = ∑(bi/pi) * K.

(5) **Child–Woman Ratio (CWR)**: This is also sometimes used to calculate birth-rate of absence of classified birth-statistics. This is calculated on the basis of division of survivors by the mothers.

CWR = P_{0-4}/F_{15-49} * K, where, P_{0-4} = stands for the number of children of both sexes of less than five years of age; F_{15-49} = stands for the number of woman of age 15–49 years; K = constant 1000.

Like fertility, mortality measurements are of vital importance in human life. These measures considered as determinants of reproductive health and for formulating suitable population policies. Mortality measurement is also useful to calculate natural increase and decrease in population growth. It is measured in different heads, viz., crude death rate, neonatal mortality rate, infant death rate, under 5 mortality and age-specific death rates.

4. Data analysis using measures of mortality

(1) **Crude Death Rate (CDR)**: Like crude birth rate, crude death rate is also a ratio of total deaths registered and the total population of a country in a particular year. This is generally called deaths per thousand persons per year and can be calculated by following formula:

CDR = D/P * K, where D is total registered deaths in a year; P is the mid-year population in a year; K is constant (taken as 1000).

(2) **Infant Mortality Rate (IMR)**: Infant death rate is a vital part of total deaths of a country-developed or underdeveloped, is ratio of total deaths of age-group (0–1) and total births in that particular year and mathematically can be expressed as follows:

$IMR = D/B * K.$

(3) **Neo-natal Mortality Rate (NMR)**: It is another correction in the mortality measurement which is more accurate and refined, calculated in the following manner: $NMR = D/B * K$

(4) **Under 5 Mortality Rate (U5MR)**: The Under-5 Mortality Rate refers to deaths from birth up to a child's fifth birthday calculated as the number of deaths in the 0 to <5 years age group per 1,000 live births.

Under Five Mortality Rate = No. of child deaths (0-<5)/No. of live births * 1000.

(5) **Cause Specific Death Rate (CSDR)**: Generally, an event of death is more related to the environment, disease, level of public health services, accidents and violent activities in that continent.

$CSDR = Di/P * 1000$, where D*i* = no. of deaths due to some particular cause in a year; P = mid-year population, K = constant.

Mid-year Population: The mid-year population refer to the population that usually falls in the mid-day of the survey period. It is also referred to as the mean population.

Socio-economic variables: In the present study, the socio-economic variables such as education, occupation and income are considered as independent variables in the process of determining fertility and mortality levels of women. These variables have been computed to retrieve mean, standard deviation, R-Square values, and subsequent Cox-Regression analysis for each group separately to ease comparison.

Cultural variables: The cultural variables such as age at menarche, age at marriage, age at first conception have been computed for mean and standard deviation values among three groups. Age at marriage has been considered as an independent variable for R square calculation. Further, age at marriage and age at first conception has been considered as an independent variable for Cox-Regression Analysis.

An R-squared value is a measure of regression model that determines the proportion of variance in the dependent variable that can be explained by independent variable. R-squared can take values between 0 and 1.

Finally, Cox Regression analysis has been used to understand the association of the predictor variables with fertility and mortality levels among the study groups.

5. Results

Changes occurring in a population across time and space can be understood with the occurrence in the number of births and deaths. Such changes are influenced by socioeconomic characteristics, cultural factors, the fertility rate(s), mortality rate(s) etc. The socioeconomic characteristics include marital status, education, occupation, and cultural factors such as age at menarche, age at marriage, age at first conception, etc.

Table 1 demonstrates the distribution of women included in the study based on their present age, sex ratio, age at menarche, age at marriage and their conceptions. The sex ratio among Kawar (416.4) is reported more when compared with Birhor (349.11) and Gond (227.66). The cultural factors for the present study include age at menarche, age at marriage, age at first

Table 1. Socio-economic and cultural factors of Gond, Birhor and Kawar tribes

Socio-Economic and Cultural Factors	**GOND*(n = 146)***	**BIRHOR*(n = 151)***	**KAWAR*(n = 78)***
Sex ratio	**227.66**	**349.11**	**416.4**
Cultural Factors include			
Age at Menarche	***(n = 30)***	***(n = 10)***	***(n = 12)***
≥ 12 years	25 (83.3)	-	6 (50)
13 years	1 (3.33)	3 (27.27)	1 (8.33)
14 years	1 (3.33)	-	2 (17)
15 years	1 (3.33)	5 (45.45)	1 (8.33)
16 years	2 (7)	2	1 (8.33)
Mean ± SD	12.6 ± 1.5	12.5 ± 1.1	13.6 ± 2.0
Age at Marriage	***(n = 35)***	***(n = 40)***	***(n = 12)***
≥ 14 years	6 (17.14)	2(5)	4 (33.33)
15–19 years	24 (68.57)	36 (90)	8 (67)
20–24 years	5 (14.28)	1 (2.5)	-
25–29 years	-	1(2.5)	-
Mean ± SD	17.0 ± 2.5	18.8 ± 1.7	16.3 ± 2.1
Age at First Conception	***(n = 34)***	***(n = 40)***	***(n = 12)***
13 years	1 (3)		-
14 years	1 (3)	-	-
15 years	-	-	2 (16.66)
16 years	2 (6)	2 (5)	2 (16.66)
17 years	2 (6)	4 (10)	-
18 years	-	4 (10)	2 (16.66)
19 years	14 (41.17)	4 (10)	4 (33.3)
20 years	4 (12)	23 (58)	-
21 years	5 (15)	1 (2.5)	1 (8.33)
22 years	1 (3)	1 (2.5)	-
Mean ± SD	19.6 ± 2.9	18.8 ± 1.7	18.6 ± 3.7
Socio-Economic Factors include			
Educational Level*			
Non-literate	49 (33.56)	75 (49.66)	18 (23.07)
Primary education	34 (23.28)	30 (19.86)	25 (32.05)
Upper primary	21(14.38)	21 (13.90)	10 (12.82)
Secondary & Higher secondary	37 (25.34)	5 (3.31)	16 (20.51)
Graduation	3 (2.05)	-	5 (6.41)
Occupational Categories#			
Agriculture	72 (49.31)	55 (36.42)	14 (17.94)
Wage Labour	36 (24.65)	36 (23.84)	24 (30.76)
Others	3 (2.05)	26 (17.21)	1 (1.28)

("n" denotes the sample considered for that defined category)

**Educational Level: Gond (n = 144); Birhor (n = 131); Kawar (n = 74) has been considered (as children below 5 years are not considered under non-literate category to the total population as recorded).*

#Occupational Categories: Gond (n = 111); Birhor (n = 117); Kawar (n = 39) have been considered as the remaining reported either they are studying or some belong to the childhood category to the total population).

conception, A menarche is an important event in a woman's biological and social life. Menarche is the beginning of the reproductive phase and is significant for anthropological demographers who are dealing with fertility and mortality from an anthropological perspective. Most of the girls belonging to the Gond (83.3%) and Birhor (50%) groups attained menarche during the age of 12 years. It is reported that the Kawar (45.5%) girls attained menarche during the succeeding ages of 13 years. From Table 1, it is noted that the mean age at menarche and standard deviation of Gond (12.6 ± 1.5), Birhor (12.5 ± 1.1) and Kawar (13.6 ± 2.0) are approximate. In the present study, the mean age at menarche among Kawar is higher when compared with their counterparts. This indicates that menarcheal age varies considerably among different populations.

Age at marriage is another important cultural event that brings changes in the biological life cycle of any individual. It is considered as a cultural event as marriage is influenced by cultural value which definitely varies one from the other. Women attain social approval to conceive and deliver children through wedlock relationships. Marriage is the beginning of conjugal life, which reflects the reproductive span that influences fertility and growth in the size of any population. It is evident from Table 1 that the first age of marriage occurs during 15–19 years of age. The mean age at marriage and standard deviation reported 17.0 ± 2.5 (Gonds), 18.8 ± 1.7 (Birhor) and 16.3 ± 2.1 among the Kawar group.

Age at the first conception of women in different age groups is shown in Table 1. The majority of the Birhor (58%) women experienced conception during 20 years age group followed by Gond (41.17%) women. In contrast, age at first conception among Kawar is observed during the 15–16 years and 18 years age group. Further, it is evident from the mean and standard deviation of the variable, age at first conception among Kawar (18.6 ± 3.7), is followed by Birhor (18.8 ± 1.7) and Gond (19.6 ± 2.9) women. This situation can be attributed to the practice of early marriage that led to early conception and subsequent influence on reproductive health due to low education levels among Kawar and Birhor women.

Socioeconomic factors include education, occupation and income of a society which relate to each other. Educational attainment is an important characteristic of household members. Many phenomena such as reproductive behaviour, age at marriage, age at conception, maintaining birth spacing, child care and proper hygienic habits are affected by the education of household members. Table 2 shows the social factors that enable to understand the educational attainment of household members. In the present study, educational attainment is classified as non-literate(s), primary, upper primary, secondary & higher secondary, graduation and post-graduation for each group. It is observed that majority (35.11%) of Birhor women are non-literate and 20.27% of Kawar women have obtained primary education than their counterparts.

Occupation is a source of empowerment for men and women, which brings control of income to meet the minimum household needs of the family. Table 3 depicts that Gond (32.19%) and Birhor (23.84%) practise agriculture as their primary occupation followed by wage labour as a secondary occupation. It is noticed that men's contribution towards the economy is comparatively more than women indicating gender-based occupational prioritization. Kawar consider wage labour (17.94%) as the primary occupation followed by agriculture. This indicates that men's contribution towards economy is more when compared with women in the present study.

Table 4 depicts the relationship between the number of live births and its influence on socio-economic and cultural predictors. It is noticed that the variation in the number of live births reported showing changes with age at marriage ($R = 0.31$) among Kawar which means that 31.4% of the dependent variable's variance exists. However, a low R-squared value indicates that the socio-cultural variables are not explaining many variations in the number of live births among study groups. In addition, the recorded p-value of all the predictor variables is not statistically significant indicating that the effective size is too small to study the influence of variables on fertility.

Table 2. Educational status among Gond, Birhor and Kawar tribes

Study Population	Non-literate		Primary		Upper primary		Secondary & higher secondary		Graduation		Post- Graduation	
	M	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Gond(*n* = 144)	22(15.27)	27(18.75)	22(15.27)	12(8.33)	9(6.25)	12(8.33)	21(14.58)	16(11.11)	1(0.69)	-	-	2(1.38)
Birhor(*n* = 131)	29(22.13)	46(35.11)	19(14.50)	11(8.39)	12(9.16)	9(6.87)	5(3.81)	-	-	-	-	-
Kawar(*n* = 74)	8(10.81)	10(13.51)	10(13.51)	15(20.27)	4(5.40)	6(8.10)	7(9.45)	9(12.16)	1(1.35)	4(5.40)	-	-

(Figures in parenthesis indicate percentage(s))

Table 3. Occupational status among Gond, Birhor and Kawar tribes

Tribes	Agriculture		Wage labour		Salaried & Others	
	M	F	M	F	M	F
Gond	47(32.19)	25(17.12)	22(15.06)	14(9.58)	1(0.68)	2(1.36)
Birhor	36(23.84)	19(12.58)	21(13.90)	15(9.93)	4(2.64)	22(14.56)
Kawar	8(10.25)	6(7.69)	14(17.94)	10(12.82)	-	1(1.28)

(Figures in parenthesis indicate percentage(s))

Table 4. Impact of socio-economic and cultural predictors on fertility

Study group(s)	Predictor variables	*R* square	*P* value
Birhor	# Age at Marriage	0.000*	0.88
	€ Education € Occupation € Income	0.038* 0.064 0.002*	0.30 0.21 0.82
Gond	# Age at Marriage	0.025*	0.41
	€ Education € Occupation € Income	0.060 0.004* 0.001*	0.18 0.73 0.82
Kawar	# Age at Marriage	0.314	0.07
	€ Education € Occupation € Income	0.025* 0.001* 0.017	0.63 0.89 0.69

*(*p-value statistically significant at 0.05 level)*

 # Age at Marriage considered as cultural variable

€ Education, Occupation and Income considered as socio-economic variables.

Fertility is considered a natural ability to conceive and produce offspring. Mortality is the incidence of death in a population, measured in various ways, often by the probability that a randomly selected person in a population at some date and place would die during some period of life.

Fertility and mortality information of ever pregnant women among the present study population is reported in Table 5. The highest frequency of pregnancy wastage including abortions and miscarriages (2.33%) occurred among Birhor and Kawar (2.70%) than that Gond. Similarly, the incidence of child deaths (9.34%) is high among the Birhor tribe and not in the other two study tribes. The mean and standard deviation of the pregnancies among Birhor (1.95 ± 1.7), Gond (1.70 ± 1.5) and Kawar is (2.58 ± 2.2). This indicates that majority of the live births have occurred among Kawar (86.48%) followed by Birhor (63.08%) and Gond (50.27%) to compensate the substantial prenatal loss.

Table 6 provides the characteristics of the population with number of women, number of live births and post-natal deaths during the last one year. Moreover, certain measures of fertility have been used to understand the fertility trends of the study populations. It is clear from the above table that crude birth rate (CBR) is high (72.36) among Gond followed by Birhor (39.21) and subsequently by Kawar (25) group. Next to CBR, General Fertility rate is the number of live births per 1000 women between the ages of 15 and 49 years. It is the simplest overall age and estimated measure of women of child-bearing age. General fertility rate does not show a definite pattern. Despite the crude birth rate is moderate, general fertility rate is high which indicates that the number of women in 15–49 age group(s) is smaller when compared to the total population which is larger.

Age Specific Fertility rate is the cumulative number of children born to an eligible woman in the succeeding age groups. As the rate of child-bearing is not uniform throughout all ages the schedule of age-specific fertility rate(s) shows the extent and pattern of age differential. It is

Table 5. Fertility and mortality among ever pregnant women

Results of Conception	Gond	Birhor	Kawar
i) Miscarriages and Abortions	-	5(2.33)	1(2.70)
ii) Still births	-	1(0.46)	_
iii) Live birth	92(50.27)	135(63.08)	32(86.48)
iv) Neonatal	8(4.37)	7(3.27)	3(8.10)
v) Infant	-	2(0.93)	-
vi) Child deaths	1(0.54)	20(9.34)	1(2.7)
vii) No. of pregnancies	82(44.8)	44(20.56)	-
Total Conceptions	183	214	37

*(*Figures in parentheses indicate percentage)*

Table 6. Population size and child deaths among women for the last one year

Characteristics	Gond	Birhor	Kawar
Total population	146	151	78
Mid-year population size	152	153	80
Mid-year population aged 15–49 years	43	50	29
Women aged 15–49 years at the end of the year	43	48	28
Currently married women (15–49)	33	44	20
No. of live births in a year	11	6	2
No. of neonatal deaths	8	-	3
No. of infant deaths	-	-	-
No. of child deaths (under 5)	4	20	1
Measures of Fertility Crude Birth rate	72.36	39.21	25
General Fertility rate	255.81	120	68.96
Age Specific Fertility rate	194.8	2342.7	1700.0
Total Fertility rate	9.8	11.71	8.5
Child–Woman ratio	766.66	833.33	1857.14
Measures of Mortality Crude Death rate	32.89	26.14	-*
Neonatal Mortality rate	86.95	51.85	93.75
Infant Mortality rate	-*	14.81	-*
Under 5 Mortality rate	10.86	148.14	31.25

**No cases occurred/ reported for the last one year from the sample population*

more accurate than the estimates of Crude Birth rate and General Fertility rate. This is due to the fact that only the women in the child-bearing age are considered and not the population, the emphasis being made to a specific period of time in relation to live births of women according to her age. In the present study, the ASFR is 194.8 among Gond, 2342.7 among Birhor and 1700 among Kawar tribe. The age specific fertility rate among Birhor reported high when compared with Kawar and Gond groups.

Total Fertility rate of a population is the average number of children that would be born to a woman over her lifetime in five-year age group(s) multiplied by five. This rate is calculated by considering the single-year age-specific rates at a given time. The total fertility rate estimate(s) the number of children for a group of 1,000 women that would bear if they all went through their child-bearing years exposed to the age-specific birth rates for a particular time. Total fertility rate estimates the fertility growth factor in a population, e.g., whether the child-bearing population is replacing itself or not. It is observed that the total fertility rate is high among Birhor (11.8) followed by Gond (9.8) and Kawar (8.5) indicating a higher chance of fertility or women experiencing more number of live births.

Fertility level of a woman can also be understood through child–woman ratio. A child–woman ratio is a commonly used measure of fertility calculated from the age-sex distribution. Child–woman ratio is calculated as the number of children between 0 and 9 years to women aged 15–49 years in each population, which is also termed as Fertility ratio. However, child–woman ratio recorded high among Kawar (1857.14) followed by Birhor (833.33) and found to be high when compared with other study populations among Gond (766.66).

Population variation occurs not only with the influence of fertility measures but also with the mortality measures across time and space. The crude death rate is one of the simplest and most common measures of mortality. Crude Birth rate is the ratio of total live births to the total population in a specified community or area over a specified period. The birth rate is often expressed as the number of live births per 1,000 populations per year, a measure designed to give information on the comparative fertility of different population, most commonly used in demographic analysis. From the above table, it is clear that the crude death rate is high among Gond (32.89) followed by Birhor (26.14) and the crude death rate is not calculated among Kawar due to absence of deaths during the last one year.

Further information on mortality is understood with neonatal, infant and child mortality. Neonatal mortality rate is defined as the ratio of the number of deaths within the first 28 days of life to the number of live births occurring in the same population during the same period of time. Majority of neonatal deaths reported among Kawar (93.75) followed by Gond tribe (86.95) and Birhor (51.85). In addition to this, infant mortality rate is also a useful indicator of a country's level of health or development, which is a component of the physical quality of life index. The most common cause of infant deaths worldwide has traditionally been due to dehydration from diarrhea. It is recorded from the above table that infant deaths have occurred among Birhor (14.81) while the infant deaths among Gond and Kawar for the last one year have not been observed.

Under-five (years) child mortality rate is a leading indicator to understand the level of child health and overall development in a country. It is the probability of a child born in a specific year or period dying before reaching the age of five, if subject to age-specific mortality rates of that period. From the above table, it is clear that the deaths of children under 5 years were recorded high among Birhor (148.14) than the other study groups.

Event of death is more related to the environment, disease occurrence, availability and access to public health services, and other unforeseen activities in that area. Death rate recorded from a given disease is another measure of mortality which is very helpful both in evaluating the effectiveness of health services in different communities. This also indicates the demand and direction of health services in need. From the above Table 7, it is clear that most of the deaths reported due to fever, vomiting and dysentery. Contrary to this, it is also reported that the deaths occurred due to snake bite (19.60%) among Birhor.

A Cox regression model (Cox, 1992) is used to identify the relative risk values for different predictor variables measured at different levels of socio-economic and cultural factors over a time.

Table 7. Cause specific death rate among Gond, Birhor & Kawar Tribe

Tribe	Fever	Urine problem	Vomitting	Dysentry	Accident	Stone	Snake bite	Malaria
Gond	32.89	6.57	6.57	6.57	6.57	-	-	-
Birhor	32.67	-	26.14	39.21	-	0.65	19.60	0.65
Kawar	12.5	-	-	-	-	-	-	-

For this study, four predictor variables/covariates used to predict the status of under-five mortality. Cox proportional hazards regression expression estimates a hazard ratio. Hazard is the probability of dying at a given point of time. The following table shows hazard values for the predictor variables;

From the above Table 8, the result of Cox regression model suggests that death of child before (under) 5 years occurring among Gond women shows that the hazard ratio is 1.2 with 95% CI = (0.848, 1.723), $p = 0.2$ indicating that early age at marriage of girls increased the hazard by 12%. Further, it is also observed that the respondents' occupation level has drastic effect indicating the risk of the child deaths before attaining 5 years of age increase by 1.0 with 95% CI (.950 & 1.135), $p = 0.4$ however, the finding indicates that the predictor variables are not statistically significant. This is not to say that the predictor variables are not associated with the cause of mortality and likely due to confounding. Though statistically not significant, the hazard (HR>1) indicates that the risk of dying increases relatively by one unit change due to early age at marriage and occupation categories.

From the above Table 9, it is reported that the Cox regression suggests the incidence of under 5 years child deaths among Birhor women shows that the (death of children) hazard ratio is 1.3 with 95% CI = (0.598, 3.074), $p = 0.4$ indicating that early age at marriage has drastically increased hazard of death by 13% at any point of 1 year study for follow-up period. It is also observed that the respondents' educational level is low and the risk of the child death before attaining 5 years increase by 1.1 with 95% CI (.000 & 1.338), $p = 0.9$ indicating the chances of hazard increase by 11% over time. However, the finding indicates that the predictor variables are not statistically significant as the hazard ratio increases with continuing low levels of educational attainment among women, practice of early marriage(s) and occupation levels found more than one.

From Table 10, the result of Cox regression model suggests that under 5 years of child deaths occurring among Kawar women (hazard ratio) is 1.9 with 95% CI = (0.151, 24.831), $p = 0.6$ indicating that early age at first conception has drastically increased the hazard by 19%. Further, it is also observed that the respondents' occupation level would further result in the risk of the child death by 13% before attaining 5 years of age. The condition reflected with an increase by 1.03 with 95% CI (.000 & 16.760), $p = 0.3$, which further predisposed with low levels of educational attainment. However, the finding indicates that the predictor variables are not statistically significant as the hazard ratio increases with age at first conception and occupation categories reported more than one.

6. Discussion

Population variation occurs due to fertility, mortality and morbidity from one population to another across time and space. Some cultural factors like age at menarche, age at marriage, age at first conception, number of conceptions, and live births determine fertility, and socio-economic factors like, educational status, occupation, income, etc., govern and shows the fertility status of a group. Demographic studies in India are reliable to understand the level of risk of death due to child mortality (Hughes et al., 2001; Jalan & Ravallion, 2003; Srivastava et al., 2021; Wagstaff & Claeson, 2004). The factors influencing such state of mortality are related to the mother's education, onset of age at menarche, age at marriage, age at first conception, and occupational categories (Gaiha et al., 2009; Gragnolati et al., 2006; Haq, 2018; Madise et al., 1999; Measham et al., 1999; Nair, 2007; Ramalingaswami et al., 1996; Sastry, 1997; Virmani, 2007).

In the present study, age at menarche does not affect the fertility status of women (Table 1). The mean age at menarche of Gond (12.6) and Birhor (12.5) are almost in line with Koms of Manipur (12.50; Kiranmala et al., 2011), Meities of Manipur (12.54; Kiranmala et al., 2011) and Maharastrian girls (12.62; Rokade & Mane, 2009) and high when compared with Punjab girls (12.38; Mittal & Goel, 2010), Lucknow girls (12.43; Khatoon et al., 2011), Assamese and Bengali girls (12.45;

Table 8. Impact of socio-economic & cultural factors on mortality among Gond Tribe using Cox Regression Model

Variables	B	SE	Wald	Df	Sig.	Exp(B)	95% CI for Exp(B)	
							Lower	Upper
*Education	−.004	.006	.387	1	.534	.996	.984	1.008
*Occupation	.038	.045	.690	1	.404	1.038	.950	1.135
#Age at Marriage	.190	.181	1.103	1	.294	1.209	.848	1.723
#Age at First Conception	−.124	.158	.611	1	.434	.884	.648	1.205

**Socio-economic variables*

 # Cultural variables

Table 9. Impact of socio-economic & cultural factors on mortality among Birhor Tribe using Cox Regression Model

Variables	B	SE	Wald	Df	Sig.	Exp(B)	95% CI for Exp(B)	
							Lower	Upper
*Education	.146	5.948	.001	1	.980	1.157	.000	1.338
*Occupation	.011	.008	1.743	1	.187	1.011	.995	1.028
#Age at Marriage	.304	.418	.531	1	.466	1.356	.598	3.074
#Age at First Conception	−.536	.460	1.360	1	.243	.585	.237	1.440

**Socio-economic variables*

 # Cultural variables

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Table 10. Impact of socio-economic & cultural factors on mortality among Kawar group using Cox Regression Model

Variables	B	SE	Wald	Df	Sig.	Exp(B)	95% CI for Exp(B)	
							Lower	Upper
*Education	.006	.020	.097	1	.755	1.006	.968	1.046
*Occupation	.030	.216	.019	1	.890	1.030	.674	1.574
#Age at Marriage	−2.617	2.774	.890	1	.345	.073	.000	16.760
#Age at First Conception	.661	1.301	.258	1	.611	1.937	.151	24.831

**Socio-economic variables*

 # Cultural variables

Deb, 2009), and subsequently low when compared with Gond (13.5), Binjhwar (13.2), Savara (12.08) Premi, 2015) of Chhattisgarh. The results of mean age at menarche among Kawar (13.6) group is in accordance with Hill Korwas (13.67; and relatively high when compared with Thotis of Andhra Pradesh (13.06; Elizabeth et al., 1998), Adolescent Khasi girls (13.22; Deb, 2011), Oraons of Assam (13.26; Gogoi & Sengupta, 2003), Khasi girls (13.22; Deb, 2011), Saharia (13.5; Biswas & Kapoor, 2004), Gonds (12.8; Sharma & Chowdhury, 1995), Kamar (13.49; Biswas et al., 2001) of Madhya Pradesh.

In the present study, the mean age at marriage is (16.3 ± 2.1) among Kawar, (17.0 ± 2.5) among Gond and (18.8 ± 1.7) among Birhor. The mean age at marriage reported among Birhor is in accordance with the national standards for girls with a minimum marriageable age limit; nevertheless, there is an age difference between the onset of menarche with that of marriage. However, this difference is quite close to Kawar and Gond populations. From Table 1, it is clear that the majority of the girls have married during the (15–19 year) age group indicating an inclination toward the cultural preference of early marriage among girls. The results are in line with Bhots & Kinnaurs (Bhasin, 1990; Pathania et al., 2008), Gujjars of Delhi (Dabral & Malik, 2004), and Jats of Haryana (Chandiok et al., 2016). In addition, the mean age at first conception is 18.6 ± 3.7 and 18.8 ± 1.7 among Kawar and Birhor, respectively. Contrary to this, studies also reported a very early marriage (<14 years) among girls (Lal, 2006; Pandey, 2001) increases effective married life and the probability to have more children (Bhattarai et al., 2022; Khongsdier, 2002; Mutharayappa, 1994; Nanda, 2005; Shrivastava et al., 2021). Thus, the practice of early marriages among girls results in an increase in the number of live births. The mean age at first conception among Kawar and Birhor is early compared to Gond (19.6 ± 2.9). The results of the present study group, Gond are in accordance with Gujjars of Delhi (Dabral & Malik, 2004) and Jats of Haryana (Chandiok et al., 2016).

It is also reported that the majority of the respondents are non-literate in the present study. The educational status enables women to decide towards managing their reproductive life which influences the family size. Hence, educational attainment is one of the important social factors that affect fertility. In addition to this, a low level of educational attainment among women also experienced high infant mortality (Bharathi, 2013). The other factors include their belief in the practice of the indigenous method of delivery, unhygienic surroundings, and lack of awareness leading to ill health situations. Health education strengthens to improve maternal and child health-care services for safe delivery. However, priority has to be given to improving literacy levels among women which enhances safe motherhood (Verma, 2002) and for a better reproductive health initiative approach. The average annual household income is an important variable which indirectly influences infant mortality (Verma, 2001).

Fertility is affected by many different cultural, socio-economic and environmental factors, as seen in many different cultures and societies (Adhikari, 2010; AL-Khandari, 2007; Bharathi et al., 2016; Chaudhry, 1990; Davis & Blake, 1956). Fertility is also influenced by society type (Hollos & Larsen, 1992; Reher & Iriso-Napal, 1989), education, and occupation, especially for women, are other important factors that influence fertility. Educated and employed women are more likely to use contraception than those who have meagre education and who are not employed (Abdi et al., 2020; Hoque & Murdock, 1997).

It is interesting to note that the results of crude birth rate (CBR) narrowed down among the study populations subsequently from Gond (72.36) to Birhor (39.21) and to Kawar (25). In the present study, the crude birth rates when compared with the values of Chhattisgarh (rural) show 24.1 (Sample Registration System (SRS), 2017) which is approximately equal to that of Kawar group. Similarly, the General Fertility Rate, a refined measure of fertility reported high among Gond (255.81) followed by Birhor (120) when compared with the values of Chhattisgarh (86.7) and found low when compared with Kawar (68.96). This indicates the occurrence of a greater number of live

births among Gond and Birhor than Kawar. This also indicates the effect of the size of the population on fertility.

Based on the data of live births a woman experienced during her reproductive life is vital to understand the extent of fecundity during 15–49 years of age group. The age-specific fertility rate is higher among Birhor followed by Gond and Kawar. Fertility reached a peak during the early ages of reproductive history. The cumulative value of ASFR gives a measure of Total Fertility Rate (TFR) indicating the average number of live births born to a woman during her entire reproductive life. TFR values reported among Birhor (11.71) is followed by Gond (9.8) and Kawar (8.5) which shows extremely high when compared with the values depicted among the rural population (2.6) of Chattisgarh and (2.4) India (Sample Registration System (SRS), 2017).

Mortality is one of the basic indicators to understand the levels of population change occurring. Further, mortality rates of a population record the essential data of deaths occurring in different age groups right from birth up to old age. In the present study, the results related to mortality rates depict the values recorded for crude death rate, neonatal mortality rate, infant mortality rate, and under five mortality rate. In 2018, the state of Chhattisgarh recorded the highest death rate (8.0) in India. The crude death rate among Gond (32.89) is found to be high followed by Birhor (26.14) for the last year when compared with state-level statistics. However, it should be noted that the death rate(s) vary from urban areas to that in rural areas and the rate of decline is higher among rural areas (7.3%) than in the urban (6.3%) areas of Bilaspur, Chhattisgarh (Sample Registration System (SRS), 2018). Neonatal rates recorded among the study population are found to be very high. All the three study groups exhibited high neonatal deaths reported as (93.75) among Kawar followed by Gond (86.95) and Birhor (51.85). These values show high when compared with the state-level annual health statistics recorded (38) in the rural areas in the state of Chhattisgarh (Annual Health Survey, 2011). It is interesting to note that NMR rate(s) at the district level, Bilaspur recorded (26) for rural areas and at the state level, Chhattisgarh reported as (34) found to be declining year after year (Annual Health Survey, 2012–2013).

Infant Mortality Rate is the crude indicator that projects the overall health scenario of a population. In the present study, the IMR is reported as high as 14.81 among Birhor. The present study groups report lower IMR rates when compared with Bilaspur (37) (Annual Health Survey, 2012–13) and Chhattisgarh (42; Sample Registration System (SRS), 2018). In contrast, IMR is found to be relatively high among the tribes of Chhattisgarh due to the gap in literacy rates (Kosaria & Chakraborty, 2015; Ranjan et al., 2018; Victoria et al., 2020). Under Five Mortality rate(s) depicts the number of children dying before reaching 5 years of age. In the present study, under five mortality rate is recorded highest among Birhor (148.14) when compared with the rural areas of Bilaspur (52) and Chhattisgarh (65) (Annual Health Survey, 2012–2013). Nevertheless, the values of under five mortality reported relatively less among Kawar and Gond.

7. Conclusion

Effective population size exists among Gond and Birhor while Kawar group is in transition. Fertility among women reached a peak during the early reproductive ages. CWR and TFR reported high indicating preference towards a greater number of conceptions resulting in high fertility. However, the levels of fertility among Kawar and Birhor were reported high to compensate the real fertility loss in the form of prenatal and postnatal mortality. NMR among Kawar, under-five mortality among Birhor reported high resulting in differences. Women have insufficient knowledge of birth preference and hence exercise many live births at an early age. The cultural practice of early marriage resulted in prolonged married life which subsequently affects in procuring of more children. This situation worsens the carrying capacity of women at an early age resulting in prenatal loss which also leads to high fertility. Disparities in levels of fertility and mortality exist due to socio-economic and cultural factors with varied reproductive behaviour. Further, it is noted that woman does not have awareness of postnatal care associated with the chances of spreading

communicable diseases. Nevertheless, it is observed that Gond is a well-educated tribe with good occupational status when compared with Birhor and Kawar ethnic groups.

However, child deaths are preventable if women had improved access to and if further acquainted with knowledge gained through reproductive health information that shapes and improves their as well as child lives. This knowledge further motivates women with low education to understand the ill health effects on mother and child emerging due to the practice of early marriage. The idea to reduce recurring health consequences through the spread of reproductive knowledge consequently bring awareness which helps in minimizing the infirmity. In simple societies, stringent strategic implementation to access health-care information is the need of the hour. This enhanced knowledge will help women in accessing and implementing better health services, particularly in notable areas to reduce prenatal and postnatal mortality. Further, the health initiative programs need stronger systems which can definitely address child deaths and reach the women in need. These changes will bring to keep up the balance in the size of the population, and essential to train professionals for periodic visits and supply medicine supported by the community workers as they are often the first line of family care.

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Author details
Bharathi Karri[1]
E-mail: drbh249@gmail.com
ORCID ID: http://orcid.org/0000-0003-0610-6861
Gladis S Mathew[2]
E-mail: gladissmathew@gmail.com
[1] Department of Anthropology, Sambalpur University, Odisha, India.
[2] Department of Tribal Studies, Art, Culture and Folk Literature, Indira Gandhi National Tribal University, Amarkantak, India.

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The authors have obtained prior permission from the concerned subjects to maintain confidentiality in the retrieved information. Only those informants' data is considered in the study who agreed to share the under five mortality events that occurred in the reproductive history of women in a specific time.

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