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Publications :

1. Chauhan B., Chokhandre P., Kulaste B., et al. (2023). "Burden of Anemia, Hypertension and Diabetes among pregnant women in India", International Journal – Journal of BioSocial Science, https://doi.org/10.1017/S0021932022000505., January 2023
2. Hadagalimath M. G, Itagi R. K(2023). "The Magnitude of Outpatient Visits for Non-Communicable Diseases in Karnataka: A District-level analysis" International Journal of Health Science and Research; Vol.13; Issue: 2, DOI: https://doi.org/10.52403/ijhsr.20230215 February 2023
3. Bal Govind Chauhan, Jyoti S. Hallad, Usha Ram, Bashir Bhat, Dilip Kalita, Dilip Kumar, M.R. Pradhan (May 2023) "Utilization of Child Immunization Services during the First Wave of COVID-19 Pandemic" IIPS Working Paper 26, International Institute for Population Sciences, Mumbai, India
4. Kumar M, Kumari N, Chanda S, et al. (2023). "Multi-morbidity combinations and their association with functional disabilities among Indian older adults: evidence from Longitudinal Ageing Study in India (LASI)". BMJ open, 13(2), e062554 February 2023
5. Bhatia M, Dixit P, Kumar M, et al. (2023). "Comparing socio-economic inequalities in self-reported and undiagnosed hypertension among adults 45 years and over in India: what explains these inequalities?" International Journal for Equity in Health, 22(1), 1-17. February 2023

Following Five papers were published in Health for All in India: Prospects and Issues: A Compendium of Studies conducted by the PRCs 2021-22, MoHFW, GoI, New Delhi, Jan 2023. ISBN: 978-93-80296-71-5

6. Jyoti S Hallad, K.G. Kallihal, MS Kampli and J.A. Golndaj (2023) 'Determinants of hypertension and Diabetes Mellitus among Older adults and Elderly: Evidence form Longitudinal Ageing study in India (LASI)"
7. Shriprasad H and Suvarna K Naikar (2023) "Catastrophic health expenditure in households with older adults: Some insights from Longitudinal Ageing Study in India"
8. Chokhandre P., Channakki H., Kampli M. S. (2023). "Hypertension and diabetes services at Health and wellness centres: A services users' perspectives"
9. Basavaraj Pundappanavar, M. N. Korakoppa and Suvarna K. Naikar (2023). "Perception of Women regarding Respectful Maternity Care during Child Birth in a District of Karnataka"
10. Javeed A. Golandaj, C. N. Noolvi, S. R. Vatavati and Jyoti S. Hallad (2023). "Treatment Outcome and Associated Factors among Tuberculosis Patients in Karnataka, India"

Seminars/Workshops/Training/Meetings attended by staff

- Prof. Jyoti Hallad and Manish Kumar, presented findings of Pan India studies and attended a workshop on Large Scale data analysis from 27- 29 March, 2023 at International Institute for Population Sciences (IIPS), Mumbai.
- Prof. Jyoti S. Hallad, Director presented the key findings of the study "Menstrual Health and Hygiene among Adolescent Girls in Climate Vulnerable Areas in India" (A Pan India Study conducted by PRCs in 16 States) in front of officials of Adolescent Health Division, Ministry of Health & Family Welfare, Government of India on 04.05.2023.
- Prof. Jyoti S. Hallad, Director and Mr. Manish Kumar, Asst. Professor presented the key findings of the study "Understanding the Context of Caesarean Delivery from the Providers' and Receivers' Perspectives in India" (A Pan India Study conducted by PRCs in 5 States) in front of officials of Maternal Health Division, Ministry of Health & Family Welfare, Government of India on 08.05.2023.
- Census Data Research Workstation was inaugurated by Shri Sajjansingh Chavan, Director Census operations, (Karnataka) on 15th June 2023 at JSS institute of Economic Research and Population research centre (PRC) Dharwad. During the occasion Dr. Ajith Prasad, Secretary JSS, Ms.Anjali Rawat, Deputy Director General MoHFW GoI, Shri Kumar Sundaram, Director, MoHFW, GoI Dr., Jyoti S Hallad Director PRC Dharwad and other PRC officials were present
- Centre organized Programme Management Unit (PMU) meeting of PRCs during 15-16 June, 2023 in which officials of MoHFW, GoI, New Delhi PMU members and PRC officials were present.
- Anti-tobacco awareness campaign was organized to JSS Kannada medium students by JSS IER Dr. D. Veerendra Heggade chair (DVH Chair) in collaboration with District Tobacco Control Board, Dharwad, on 13th February, 2023.

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ARTICLES

Application of Binary Logistic Regression Model to study the Influence of Proximate and underlying factors on under five mortality in Odisha: NFHS-4 & 5 data Analysis

Srinibasa Sahoo[1]& Ranjan Kumar Sahoo[2]

Abstract

A reduction in child mortality has been noted in Odisha in recent time and although the trend has been projected to continue to decline, studies have shown that the decline in under-five mortality has stalled and the effect more outstanding at different levels. This study examined how socio-economic, demographic factors and nutritional factors (underlying factors), direct factors (proximate determinants) through which the underlying factors influence under-five mortality. It used data from the National Family Health Survey (NFHS) of 2015-16 & 2019-20. The underlying factors considered are mother's age, education, geographical region of residence, urban/rural residence, wealth status and religious affiliation. The proximate determinants examined are, child's birth order, number of births mother had within the previous five years of the survey, whether or not the child was ever breastfed, the household source of drinking water, type of toilet facility, type of cooking fuel. Statistical analyses used were the bivariate and the multivariate analyses. Due to the binary nature of the dependent variable (Dead or Alive), the multivariate analysis technique adopted was the "binary logistic regression". Findings showed that all the seven underlying factors had a significant indirect bivariate relationship with under-five mortality. At the multivariate analysis level, all the underlying factors except religion and caste maintained their significant indirect effects on under-five mortality. Further, the children who were never breastfed were more likely to die before five years of age than children who were ever breastfed.

Keywords: Binary Logistic regression, Under-five mortality, Underlying factors, proximate determinants

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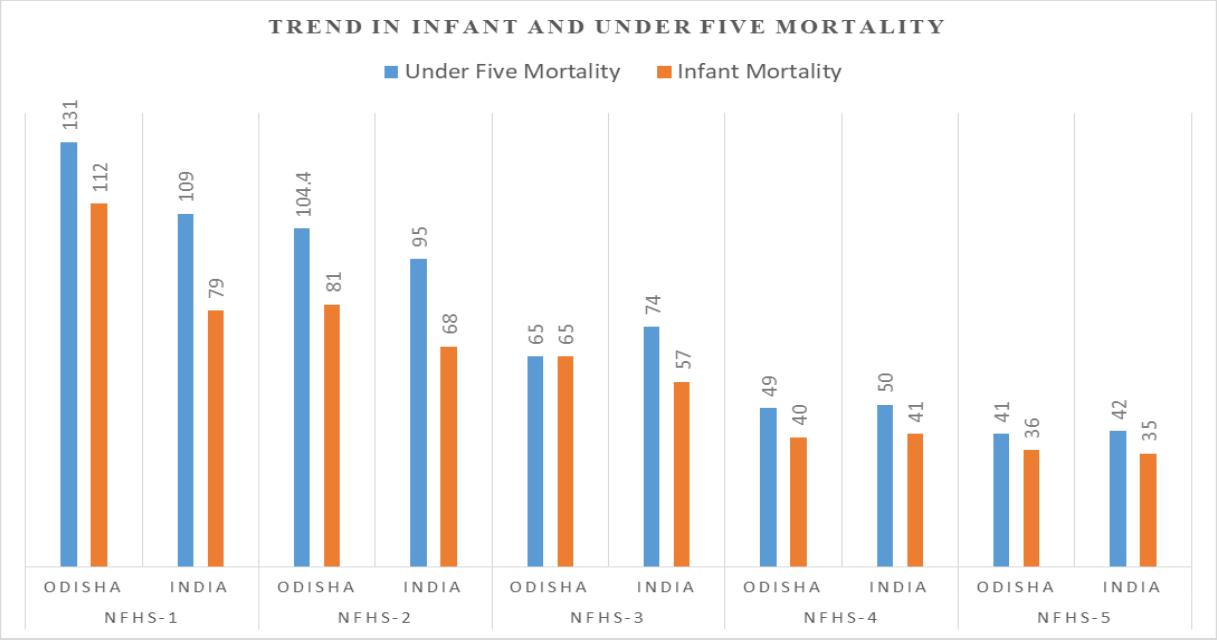
Overview of Under-five Mortality

India has witnessed a more than 50% reduction in under-five mortality rate between 1992 and 93 and 2019–21. From 1992 to 93 to 2019–21, the annual decrease in rural and urban under-five mortality is 1.6% and 2.7%, respectively (Kumar &Saika, 2022). During 2020 an estimated 5 million children under the age of 5 years died, mostly from preventable and treatable causes. Approximately half of those deaths, 2.4 million, occurred among newborn (in the first 28 days of life) (UNICEF, 2008).

Odisha sees rise in under five mortality more especially children belongs to schedule tribe population (NFHS-4)has increased from 65.6 per 1,000 live births in 2015-1 to 66.2 per 1,000 live births in 2021 (NFHS-5).

The mortality rate among children under age five years including neonatal, post neonatal, and infant mortality rates is an important indicator that measures the overall well-being of a country or a community. The infant mortality rate in Odisha is estimated at 36deaths before the age of one year per 1,000 live births, down from the NFHS-4 estimate of 40, the NFHS-3 estimate of 65, the NFHS-2 estimate of 81, and the NFHS-1 estimate of 112.The under-five mortality rate (U5MR) is estimated to be41 deaths before five years of age per 1,000 live births, it was 49 per 1,000 as U5MR in NFHS-4 (Fig: 1)

Fig: 1: Deaths per 1,000 live births in the five-year period before the survey



Source: NFHS Survey report

The infant mortality rate declined from 79 deaths per 1,000 live births in the five years before the 1992-93 NFHS survey to 35 deaths per 1,000 live births in the five years before the 2019-21 NFHS survey (Fig 1). During the same period, the under-five mortality rate declined from 109 deaths per 1,000 live births to 42 deaths per 1,000 live births. The infant mortality rate decreased by 56 percent over a period of 28 years. The decline in the under-five mortality rate is slightly higher than the decline in the infant mortality rate during this period (a decrease of 62 percent). Keeping in view of above high under five mortality in Odisha, the study aims to find out the determinants (Proximate and underlying factors) of influencing under-five mortality by applying statistical regression models by using NFHS-4 & 5 (IIPS and ICF) data set for Odisha.

DATA AND METHODOLOGY

The dependent and explanatory variables used in this study were available in the NFHS-4 & 5 data set. In this study the children recode data was used, this was due to the fact that, it contained all the relevant information required in this study on under-five children. For the purpose of this study, the unit of analysis was birth of child in the previous five years before the survey. Data were analysed by using IBM SPSS version 20 and STATA.

Definition of terms

Dependent Variable

The dependent variable used in this study was under-five mortality(U5M).This is defined as deaths that occur before children reach age five. In this study, the term is used interchangeably as childhood mortality, whether the child was alive, with the responses categorized as; 0= yes (Alive) or 1= no (Dead), represent the dependent variable in the dataset.

Independent Variables (underlying factors)

The independent variables which were also the underlying factors are sub-divided into socio-economic, demographic and Nutritional factors (Table 1).

Intervening Variables (Proximate determinants)

The proximate determinants used in this study are defined as; biological/ maternal factors, environmental factors and maternal health-seeking behaviour (Table 1).

Table 1: Description of Variables selected for analysis as Underlying factors and Proximate determinants for Odisha

	Variable	Category
Underlying factors:	Mothers Education	No education, Primary Secondary Higher
	Wealth Index	Poorest Poor Middle Richer Richest
	Mothers age at Birth of last child	Less than 20 years 20-30 years Above 30 years
	Religion	Hindu Other than Hindu (others)
	Caste	Scheduled Caste (SC) Scheduled Tribe (ST)
	Place of residence	Urban Rural
	Region	Partly tribal district Non-tribal district Tribal district
Proximate Determinants	Birth order	1st Order 2-3 order 4-6 order 7th order and above
	Breast feeding status	No Yes
	Source of Drinking water	Improved source Unimproved source
	Toilet facility	Improved Sanitation Unimproved Sanitation
	Cooking facility	Safe Unsafe

Methodology

Binary Logistic Regression

The Binary logistic Regression model was first introduced by David Cox in 1958 and it can be used not only to identify risk factors but also to predict the probability of success or failure of an event (Cox, 1958; Kleinbaum and Klein, 2010). This type of logistic model is used primarily to predict an event with binary outcomes. For example, 'survival vs. mortality', 'yes vs. no'. The predictor variables can either be metric or non-metric or combination of both in the model. The effect of individual predictor variable can be measured while adjusting for the predictive ability of other factors in the model (Wisz et al., 2008).

The binary logistic model was used in this study in order to examine and predict the likelihood that a child will die before getting to the age of five years in Odisha. The regression model enabled the estimation of risks of death relative to the various underlying or proximate characteristics of interest. In the model, the outcome variable was dichotomized to take the value of "1" if the event occurs (i.e., death of a child), and "0" if the event does not occur (i.e., child survives). Since the probability of occurrence or non-occurrence of an event cannot be less than 0 or greater than 1, the event probability distribution is restricted between 0 and 1 (Wondie et al., 2011).

Justification for the use of Binary Logistic Regression:

Binary Logistic Regression is a non-linear model developed in the 1940s as a substitute for Fisher's 1936 linear discriminant analysis (Fisher, 1936; Kleinbaum and Klein, 2010). Similar to other regression models, logistic regression accommodates different types of variables measured on any of the four types of measurement scale (nominal, ordinal, ratio and interval). One distinct advantage that logistic regression has over most other traditional statistical models or techniques is that, unlike those models, it's not restricted by the normality assumptions that must be satisfied on the independent variables in the model in order to make statistical inferences, thereby making it a very robust method (Kleinbaum and Klein, 2010). Unlike ordinary linear regression and two-stage least squares regression

(structural equation models), logistic regression is essentially used when predicting an event with two possible outcomes (Menard, 2010). Due to this function, the logistic regression model must necessarily take the natural logarithm of the exponential of the outcome variable unknown as the logit. The purpose of this was to create a continuous criterion as a transformed version of the dependent variable called the link function in logistic regression.

Other forms of regression models cannot tolerate this kind of variables, due to the dichotomous nature of the predicted values (i.e., 0 and 1)(Ramalho et al., 2011).Hence, binary logistic regression is used when the variables involved have binomial distribution (double peak), unlike other regression models that must satisfy the normality distribution assumption (single peak). The logistic model solves this problem by determining the "odds ratio" or simply 'odds' of an event occurring (i.e., taking a value of 1) against its non-occurrence (i.e., taking a value of 0). For example, if the chances of an event "X" occurring is P_x and the probability of non-occurrence of the event is Q_x (where Q_x =1−P_x). In the logistic model the natural logarithm of the Odds Ratio called the "log odds" (or logit) are related to a set of explanatories (or independent) variables to obtain a regression equation of the form:

$$\log\left[\frac{P}{1-P}\right] = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots \ldots\ldots\ldots\ldots\ldots + \beta_k X_k + \mu$$

The model shows the odds of under-five mortality. In this study, **P** is the probability of under-five mortality occurring, (1-P) is the probability of under-five mortality not occurring. While $\boldsymbol{X1 \ldots Xn}$represent the independent variables and$\boldsymbol{\beta 1 \ldots \beta k}$are the regression parameters; α is a constant that gives the value of under-five mortality when all the independent variables are absent in the model, and **μ** is the residual or random error term (Ayele et al., 2017).**Log (** $\frac{P}{1-P}$**)**is referred to as the logistic transformation of probability of an event (i.e., under-five death) occurring. A binary regression model was used in this study to predict the odds of occurrence of under-five mortality in Odisha as influenced by the underlying factors with or without adjusting for the proximate determinants (Mani et al, 2012).

Assumptions of Logistic Regression

The Problem of Multicollinearity

Multicollinearity happens when the effects of more than one independent variable cannot be separated on the dependent variable. The estimated regression parameters become unreliable when there is multicollinearity (Dormann et al., 2013). Hence, it was of utmost importance to take note of high inter-correlations among the explanatory variables. It was expected that the independent variable will have a strong relationship with the dependent variable, but not relating significantly with each other. The method of identifying highly correlated covariates was by producing their correlation matrix. Most linear statistical regression models are sensitive to any form of correlation among the independent variables. However, logistic regression (a non-linear model) can tolerate correlation that is as high as 0.8 to 0.9 among its variables. In this study, any two variables that have a correlation coefficient which was greater than 0.85 was considered to be highly correlated (Oni, 1985; Pallant, 2011). In this study, none of the correlation coefficients was up to 0.85 or 0.9. Hence, no variable was dropped.

Statistical analysis:

The following levels of analyses were employed. The first level focused on bivariate analyses (Zero order correlation coefficient) for the purpose of examining the unadjusted effects of the underlying and proximate variables on the outcome variable. The essence of the bivariate analyses was to identify those underlying factors that have significant bivariate effects on under-five mortality. It was also used to test for the association (Chi-square test) that exists between the underlying factors and proximate determinants on the outcome variable. The chi-square statistic was used to test for significant bivariate associations.

The third and final level of analysis was the multivariate analyses. The binary logistic regression was used to determine the adjusted indirect effects of the underlying factors on under-five mortality. Oversampling and under sampling of some sections of the population were accounted for, through the weighting factor provided by the Measure DHS where necessary [weight =V005/1000000].

Statistical Models for Testing Relationships:

1. **Model-1:** Underlying factors do not have significant effects on under-five mortality in Odisha.
2. **Model-2:** Underlying factors do not have significant effects on under-five mortality in Odisha.
3. **Model-3:** Both the Underlying factors and Proximate factors do not have significant effects on under five mortality in Odisha.

Results:

I. Correlation matrix to check multicollinearity:

The correlation matrix result was used to check for multicollinearity among the independent variables (the underlying factors and proximate determinants). The correlation coefficients are presented in Table 2 and Table 3. The result shows that there was no collinearity between the independent variables. That is, none of the coefficients was up to or greater than 0.85 (Pallant, 2011; Oni, 1988). Therefore, there was no need to drop any of the variables from the analyses.

Table: 2–Zero order Correlation Matrix showing the causes of Multicollinearity: NFHS-5

Factors	Mothers Education	Wealth Index	Age at Birth	Religion	Place of Residence	Caste	Region	Birth Order	Breastfeeding status	Source of Drinking water	Toilet Facility	Cooking Facility
Mothers Education	1.00											
Wealth Index	0.52	1.00										
Age at Birth	0.16	0.10	1.00									
Religion	-0.09	-0.05	-0.02	1.00								
Place of Residence	-0.18	-0.40	-0.03	0.00	1.00							
Caste	0.25	0.29	0.08	-0.05	-0.08	1.00						
Region	0.29	0.23	0.06	-0.16	-0.04	0.18	1.00					
Birth Order	-0.25	-0.16	-0.14	0.05	0.05	-0.10	-0.09	1.00				
Breastfeeding status	0.12	-0.05	0.10	0.02	0.06	-0.05	-0.07	-0.09	1.00			
Source of Drinking water	-0.07	-0.11	-0.02	0.04	0.07	-0.01	-0.06	0.03	0.02	1.00		
Toilet Facility	-0.29	-0.44	-0.05	0.02	0.10	-0.18	-0.15	0.08	0.06	0.06	1.00	
Cooking Facility	-0.34	-0.65	-0.05	0.03	0.37	-0.17	-0.10	0.10	0.06	0.08	0.26	1.00

Table: 3- Zero order Correlation Matrix showing the causes of Multicollinearity: NFHS-4

Factors	Mothers Education	Wealth Index	Age at Birth	Religion	Place of Residence	Caste	Region	Birth Order	Breastfeeding status	Source of Drinking water	Toilet Facility	Cooking Facility
Mothers Education	1.00											
Wealth Index	0.52	1.00										
Age at Birth	0.14	0.06	1.00									
Religion	-0.07	-0.03	-0.01	1.00								
Place of Residence	-0.20	-0.44	-0.01	-0.06	1.00							
Caste	0.26	0.29	0.07	-0.06	-0.09	1.00						
Region	0.24	0.18	0.07	-0.17	0.00	0.20	1.00					
Birth Order	-0.24	-0.15	-0.13	0.06	0.05	-0.09	-0.08	1.00				
Breastfeeding status	0.10	-0.08	0.09	0.01	0.06	-0.06	-0.05	-0.11	1.00			
Source of Drinking water	-0.07	-0.09	-0.02	0.09	0.08	0.01	-0.04	0.03	0.00	1.00		
Toilet Facility	-0.36	-0.63	-0.05	0.00	0.31	-0.22	-0.09	0.10	0.06	0.07	1.00	
Cooking Facility	-0.37	-0.68	-0.05	0.03	0.47	-0.21	-0.06	0.11	0.07	0.08	0.47	1.00

II. Association between U5M and Underlying factors, proximate determinants:

To establish the significant association between under five Mortality (U5M) and Underlying and proximate determinants, Chi-square test was applied for the NFHS-4 & 5 data set for the state Odisha. The results are given in Table 4, 5. The results reveals that except Place of living (Table 5), other variables (Underlying and Proximate determinants) have significant association with U5M, for NFHS-4 5 data.

Table: 4- Bivariate association (Chi-square) between the Underlying Factors with Under-five Mortality (U5M) in Odisha: NFHS-4 &5 data set.

Underlying Factors		NFHS-5				NFHS-4			
Variables	Category	Child survival (%)		Total (%)	Chi square	Child survival (%)		Total (in %)	Chi square
		No	Yes			No	Yes		
Mothers Education	No education	10.2	89.8	100	441.218***	12.2	87.8	100.0	774.624***
	Primary	8.1	91.9	100		9.2	90.8	100.0	
	Secondary	4.9	95.1	100		5.1	94.9	100.0	
	Higher	2.3	97.7	100		2.5	97.5	100.0	
Wealth	Poorest	9.2	90.8	100	242.896*	11.5	88.5	100.0	458.068***

Index	Poorer	7.7	92.3	100	**	9.0	91.0	100.0	
	Middle	5.8	94.2	100		7.3	92.7	100.0	
	Richer	4.9	95.1	100		5.0	95.0	100.0	
	Richest	2.5	97.5	100		3.2	96.8	100.0	
Mothers age at Birth	Less than 20 years	8.3	91.7	100	60.43***	10.1	89.9	100.0	118.934***
	20-30 years	6.4	93.6	100		7.5	92.5	100.0	
	Above 30 years	5.6	94.4	100		7.5	92.5	100.0	
Religion	Hindu	7.4	92.6	100	3.698***	9.1	90.9	100.0	3.215*
	Other than Hindu	8.3	91.7	100		8.2	91.8	100.0	
Place of Residence	Urban	5.3	94.7	100	44.209^{NS}	6.6	93.4	100.0	89.419***
	Rural	7.8	92.2	100		9.5	90.5	100.0	
Caste	Scheduled Caste	7.7	92.3	100	142.587***	10.4	89.6	100.0	162.11***
	Scheduled Tribe	9.5	90.5	100		10.7	89.3	100.0	
	Other Caste	6.1	93.9	100		7.5	92.5	100.0	

Sig: level of significance, *p<.05, **p<.01, ***p<.001, NS=Not significant.

Table: 5- Bivariate association (Chi-square) between the Proximate determinants with Under-five Mortality (U5M) in Odisha: NFHS-4 &5 data set.

Variables	Category	NFHS-5				NFHS-4			
		Child survival (in %)		Total (In %)	Chi square Value	Child survival (in %)		Total (In %)	Chi square Value
		No	Yes			No	Yes		
Birth order	1st order	8.0	92.0	100.0	38.429***	9.1	90.9	100.0	73.003***
	2-3 order	6.7	93.3	100.0		8.3	91.7	100.0	
	4-6 order	7.9	92.1	100.0		11.1	88.9	100.0	
	7thorder and above	10.8	89.2	100.0		12.5	87.5	100.0	
Breastfeed Status	No	8.3	91.7	100.0	156.23***	9.9	90.1	100.0	167.088***
	Yes	4.6	95.4	100.0		6.2	93.8	100.0	
Source of Water	Improved source	7.3	92.7	100.0	6.746*	8.8	91.2	100.0	35.076***
	unimproved source	8.4	91.6	100.0		11.0	89.0	100.0	
Toilet Facility	Improved Sanitation	6.6	93.4	100.0	63.661***	6.4	93.6	100.0	213.673***
	Unimproved sanitation	8.7	91.3	100.0		10.2	89.8	100.0	
Cooking Fuel	Safe	5.5	94.5	100.0	104.226***	5.3	94.7	100.0	200.83***
	Unsafe	8.3	91.7	100.0		9.8	90.2	100.0	

III. Logit regression analysis

Binary Logit regression results under Model-1 (Table 6) shows Mothers education are significant predictor during the data of NFHS-5 & 4 for less chance of under-five mortality. Mother with higher education have less risk of under-five mortality when compare to illiterate and less education mother. Mothers age of 20-29 years have more risk of under five deaths in NFHS-5 round data and it is insignificant in case of the mothers age 30 years and above. Mothers residing in rural areas (The place of residence have lower risk to under five mortality in NFHS-4 and it is insignificant in NFHS-5 data. The caste other than SC and ST are significant predictor in NFHS-4 round data and it is showing more risk i.e. 1.123 time more risk of under-five mortality. The religion, place of residence, caste & Region have no significant effect on under five deaths in the NFHS-5 round data.

Table-6: (MODEL-1): Binary Logistic Regression showing the effects of the Underlying factors on Under-five Mortality in Odisha: NFHS-4 &5 data analysis

Factors	Category	NFHS-5		NFHS-4	
		Odds Ratio	Sig.	Odds Ratio	Sig.
Mother Education	no education	0.302	***	0.252	***
	Primary	0.335	***	0.333	***
	secondary	0.562	**	0.581	**
	Highers [ref]				
Wealth Index	Poorest	0.487	***	0.681	**
	Poorer	0.495	***	0.749	*
	Middle	0.598	***	0.788	NS
	Richer	0.666	**	0.929	NS
	Richest[ref]				
Mothers age at Birth	20-29 years	1.219	***	1.299	NS
	30 years and above	1.306	NS	1.214	NS
	below 20 years [ref]				
Religion	other religion	1.036	NS	1.339	NS
	Hindu [ref]				
Place of Residence	Rural	1.005	NS	0.812	***
	Urban [ref]				
Caste	Scheduled tribe	0.946	NS	1.101	NS
	other caste	1.062	NS	1.123	*
	Scheduled Caste [ref]				

Region	partly tribal district	1.073	NS	1.132	*
	Non-tribal district	0.902	NS	1.046	NS
	Tribal District [ref]				
	_cons	58.715		38.609	

Sig: level of significance, *p<.05, **p<.01, ***p<.001, ref= reference category, NS=Not significant.

The independent impact of each proximate determinant on under-five mortality may be found in Table 7 (Model-2), after accounting for the influence of the other proximal components in the model. The independent effects of each of the proximate determinant of under-five mortality after adjusting for the presence of the other proximate determinants in the model, all the proximate determinants except for the source of drinking water and cooking fuel in the household found to be significant effects on under-five mortality in NFHS-5. This showed that these proximate variables can independently help to channel the effects of the underlying factors on under-five mortality in Odisha. In NFHS-4, all the proximate determinants have significant effects on under five deaths except the birth order 7th and above. The birth order of 2nd to 3rd in both the case of NFHS-5 & 4 have more risk to under five deaths.

Table 7: (Model-2): Binary Logistic Regression showing the effects of the Proximate determinants on Under-five Mortality in Odisha: NFHS-4& 5 data analysis

Variables	Category	**NFHS-5**		**NFHS-4**	
		Odd ratio	Sig	Odd ratio	Prob. Value
Birth Order	2nd-3rd order	1.264	***	1.167	***
	4 to 6th	1.128	*	0.896	*
	7 or more	0.751	NS	0.805	NS
	1st order [ref]				
Breastfeeding status	Yes [ref]				
	No	0.496	***	0.557	***
Source of Drinking water	Improved Source[ref]				
	unimproved source	0.936	NS	0.851	***
Toilet Facility	Improved Sanitation[ref]				
	Not Improved sanitation	0.795	***	0.672	***
Cooking Fuel	Safe [ref]				
	unsafe	0.64	NS	0.614	***
	constant	31.659		33.442	

The effects of the underlying factors on under-five mortality, in the presence of the proximate determinants in the model. (i.e., after adjusting for the direct effects of the proximate determinants of under-five mortality) the results show (Table-8, Model-3)) that the three underlying factors that indicated significant indirect effects on under-five mortality in model 1, maintained their significance even after adjusting for the proximate variables. The two other variables (i.e., religion and Caste) that were not significant under model 1 were also not significant in model 3.

Mothers' education still maintained its significant effect on under-five mortality. Further, children from poor or Rich households have no negative impacts on under five mortality. Also, children whose mothers were between ages 20-29 years showing more chance of under five deaths compared to the mothers age 20 years or below. Similarly, under-five children from partly tribal districts were 1.45 times more likely to die than children from the tribal district in NFHS-4 round data but there is no significant effect in NFHS-5 round data. Further, under-five children in rural areas were 0.82 times less likely to die unlike those living in urban centres in NFHS-4 data and in NFHS-5, it has no significant effect on under five mortality. Children within birth order 2-3 and 4-6 were 1.37 times and 1.43 times more likely to die compared to children who were birth order 1 in NFHS-5 round data. Similarly, in NFHS-4 data, 1.25 more likely of dying the children below five compared to 1st order of Birth. The variables like religion, place of residence, caste, Source of drinking water and cooking fuel have insignificant effect on under five mortality in NFHS-5 data. Somehow, these shows significant effect in NFHS -4 round data.

Table-8 (Model-3): Binary logistic regression results showing both underlying factor and proximate determinants on the effect of Under-five mortality: NFHS-4 &5 data set

Factors	Category	NFHS-5		NFHS-4	
		Odd Ratio	Sig	Odd Ratio	Sig
Mother Education	no education	0.320	***	0.267	***
	primary	0.348	***	0.346	***
	secondary	0.566	**	0.578	**
	Highers [ref]				

Wealth Index	poorest	0.466	***	0.696	*
	poorer	0.482	***	0.774	NS
	middle	0.584	***	0.792	NS
	richer	0.645	**	0.915	NS
	Richest[ref]				
Mothers age at Birth	20-29 years	1.210	***	1.276	***
	30 years and above	1.341	NS	1.185	NS
	Below 20 years [ref]				
Religion	other religion	1.010	NS	1.346	***
	Hindu[ref]				
Place of Residence	rural	0.989	NS	0.828	**
	Urban[ref]				
Caste	Scheduled tribe	0.921	NS	1.092	NS
	other caste	1.094	NS	1.155	**
	Scheduled Caste[ref]				
Region	partly tribal district	1.102	NS	1.145	*
	Non-tribal districts	0.929	NS	1.068	NS
	Tribal District[ref]				
Birth Order	2-3 Birth Order	1.373	***	1.256	***
	4-6 Birth Order	1.430	***	1.113	*
	7 or more Birth Order	0.999	NS	1.077	NS
	1st Order [ref]				
Breastfeeding Status	No	1.807	***	1.638	***
	Yes[ref]				
Source of Drinking Water	unimproved source	1.023	NS	0.866	**
	Improved Source [ref]				
Toilet Facility	unimproved sanitation facility	1.025	NS	0.919	NS
	Improved Sanitation Facility[ref]				
Cooking fuel	Unsafe	0.965	NS	0.961	NS
	Safe [ref]				
	_cons	45.164	0.000	32.216	0.000

Sig: level of significance, *p<.05, **p<.01, ***p<.001, ref= reference category, NS=Not significant.

Conclusion:

This study used to examine the effects of underlying factors on under-five mortality in Odisha. The study was able to identify those proximate determinants that helped to channel the effects of selected underlying factors such as mother's educational attainments, place of residence, mother's age, religion, wealth status, place of residence, caste and region on under-five mortality. The method used in the study is one of the latest and most effective methods found in the literature for assessing the determinants of child survival in the developing countries. The comprehensive use of the method in this study to explain how socioeconomic, cultural and environmental conditions affect under-five mortality in Odisha was unprecedented. Hence, the main contribution of this study is the methodological approach used to identify the pathways of influence through the underlying factors operate to affect under-five mortality.

This study was able to identify those group of mothers contributing largely to under-five mortality in Odisha. As a result, findings from this study can enhance policies that focus on quick reduction of childhood mortality in Odisha. Therefore, to rapidly achieve the SDG 3, target 3.2, policies must be channelled toward those group of mothers that were reported to be having multiple births within short period of five years, married mothers aged 20-30 years, mothers with living in partly tribal districts of Odisha, Mothers do not have breastfeeding to their children. It is important, therefore, to note that achieving the SDG 3, target 3.2 is a big task which requires an urgent and more rapid direct policy approach. Hence, it will be easier for policy makers to invest more in interventions that are achievable within a short-term period given the nearness of the target year- 2030 (i.e., encourage more women to space their births and elongate breastfeeding) than to keep investing in education, and expecting a quicker effect on under-five mortality.

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Utilization of maternal healthcare services and its determinants among a particularly vulnerable tribal group (PVTG) in Odisha, India

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Abstract

Maternal Healthcare (MHC) services are essential for pregnant women's and their newborns' well-being. However, vulnerable tribal populations, such as the tribal population, often face significant barriers to accessing and utilizing these services. This study assesses the utilization and determinants of MHC service utilization among the Juang tribe- a particularly vulnerable tribal group (PVTG), shedding light on the factors contributing to their limited access to essential maternal care.

Data from a cross-sectional mixed-method study conducted in 2020-21 using a three-stage sampling design was used. The analysis was based on quantitative data from 360 reproductive-age women, 12 key-informant interviews, and 18 in-depth interviews. Respondents who voluntarily agreed to be interviewed were interviewed using pre-tested survey instruments.

Only 11% of Juang women had full antenatal care (ANC), 51% had post-natal care (PNC) check-ups for their last pregnancy, and 63% of the last deliveries were at an institution. After adjusting sociodemographic and economic characteristics, illiterate women were less likely to have full ANC (AOR: 0.22) and PNC check-ups (AOR:0.04) than those literate. Full ANC and institutional delivery odds were lower among women from low/middle-income households. Inadequate awareness of cultural practices and distance to health facilities further lead to poor utilization of MHC services.

MHC service utilization is low and unevenly distributed among the Juang tribe, with the poor and illiterates being the most disadvantaged. Social norms that discourage early disclosure of pregnancy, perceived adverse effects of IFA, continuing preference for home delivery,

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ignorance about the importance of PNC, and distance to health facilities are the barriers to the utilization of MHC services. Results suggest that strengthening program outreach and improving women's education may be a good step toward improving maternal health among the Juang tribe.

Keywords: India, Juang, Maternal health care, Particularly Vulnerable Tribal Group

Introduction

Maternal health interests researchers because of its close ties to women's health and the country's socioeconomic development. Healthcare for expectant mothers remains a major challenge for the global public health system, particularly in developing countries (Patton *et al.*, 2010). Globally, about 808 women died due to preventable pregnancy and childbirth complications every day in 2017. In addition, a woman in a low-income country has a 130 times higher lifetime chance of dying from a maternal-related cause than a woman in a high-income country (WHO, 2017). Improved maternal health remains a challenge for India, which accounts for 12% of world maternal deaths, second only to Nigeria (WHO/UNICEF 2019). Despite enormous initiatives, the maternal mortality rate was 103 in 2017-19 in India (RGI, SRS Special Bulletin, 2022). Socially backward groups are less likely to reap the benefits of maternal healthcare services (Navaneetham and Dharmalingam, 2002). Scheduled Tribes (STs) often have the lowest performance across various health measures in India (RMRC, 2014; WHO, 2014; IIPS &Piramal Foundation, 2021). The STs are recognized based on historical disadvantage and distinct cultural traits. The Particularly Vulnerable Tribal Groups (PVTG), a subset of STs, are comparatively more isolated, primitive, vulnerable, deprived, and backward than the other 62 distinct tribes recognized by the Indian Republic. The Indian government has identified 75 tribal communities in 18 States and the Union Territories of the Andaman and Nicobar Islands as PVTGs. Juang tribe is one of the PVTGs residing in Odisha, eastern India (Ministry of Tribal Affairs, Govt. of India, 2007; Bang, Jhalani and Angami, 2022).

Maternal health care (MHC) is an essential aspect of health-seeking behavior; however, it is often neglected among tribes. Factors that influence tribal women's use of MHC services include general knowledge, cost, accessibility, service quality, and health professionals'

motivation (Jose *et al.*, 2014). The utilization of antenatal care (ANC) among STs in Chhattisgarh, Madhya Pradesh, Odisha, and Rajasthan is very poor, and the reasons behind non-utilization include illiteracy (Adhikari*et al.*, 2016). Another study found that age, parents' literacy, poverty, and marriage age are significantly associated with ANC utilization among tribal women in Karnataka (Udayar and Parveen, 2020). ANC among the Khasi tribes of Meghalaya was again found to be unacceptably low, and most of them received their first antenatal check-ups in the fifth month of their pregnancy (Deb, 2008). A study further reveals that 26 percent of tribal adolescent mothers in Jharkhand received any antenatal check-up, only 14 percent received it in the first trimester, and most preferred to deliver at home (Rani, Ghosh and Sharan, 2007). Another study in south India found a higher prevalence of home deliveries among the tribes, conducted mainly by untrained older women (Varma, Kusuma and Babu, 2011). The STs of Odisha were also found to prefer home delivery (Nayak and Babu, 2001). ANC has a considerable effect on the use of skilled attendance at delivery (Susuman, 2012), and the use of both ANC and skilled attendance at delivery considerably influences the use of post-natal care (PNC) (Dilip and Mishra, 2009). Female education is a significant contributing factor associated with the utilization of PNC in the tribal area of Madhya Pradesh (Sharma *et al.*, 2014). Traditional beliefs and practices were again found to influence the PNC of the tribes, especially new mothers in Maharashtra (Dehury, Pati and Dehury, 2018).

MHC also depends on the place of residence, occupation, and educational status, and tribal women in northeastern India are more likely to utilize maternal health facilities than those in the country's central region (Shah and Bélanger, 2011). Nevertheless, due to a lack of awareness and health infrastructure, inadequate ANC services utilization, and home deliveries by an untrained person, tribes are prone to maternal death (Mumbare and Rege, 2011). Empirical evidence on the level and predictors of MHC utilization among the PVTGs is limited in India. This study assesses the extent and determinants of MHC utilization among the Juang, a PVTG in Odisha, India.

The Juang tribe belongs to the Munda ethnic group and had a population of around 47,095 people in 2011; the bulk of them resided in rural regions of Keonjhar and Dhenkanal districts in Odisha (N. Patnaik, B.PChoudhury, K .Seeland, A.Rath, A.K . Biswal, 2007). The tribe is

primarily split into two groups: the hill Juangs, who are restricted to the hill ranges of Keonjhar and Pallahara, and the plain Juangs, who are dispersed over the plains of Dhenkanal and Keonjhar districts. The hill Juangs are still in a primitive stage, relying primarily on shifting cultivation, whereas the plains Juangs have adopted settled agriculture (Kanrar and Goswami, 2020). Juangs continue to exhibit a low literacy rate, very poor maternal and child healthcare practices, and a significant prevalence of undernutrition (Kanrar and Goswami, 2020). They are also known for their adherence to traditional customs and health beliefs. Identifying determinates of MHC services use is critical for targeted interventions and reducing these disparities and evidence-based policies and programs, potentially saving lives and enhancing the overall well-being of Juang mothers and newborns.

Methodology

Data

The current study used data from a cross-sectional mixed-method study conducted in 2020-21 among the Juang tribe in the Keonjhar district of Odisha, India. The study adopted a three-stage sampling design to choose respondents, i.e., currently married women aged 15-49. In the first stage, three tehsils (administrative divisions of a district) were chosen randomly from the 13 tehsils in the Keonjhar district that had villages with the Juang tribe. Second, after listing all villages in these tehsils with at least 50 Juang households, six villages (2 from each tehsil) were chosen randomly. During the household mapping and listing process, the availability of married women aged 15-49 was requested to identify the households in these six villages with eligible respondents. All eligible women on the list were interviewed (n=360). The sample size was determined by considering the district's concentration of respondents and the minimum sample size for any meaningful analysis. In addition, 18 in-depth interviews (IDI) of Juang women and 12 key informant interviews (KII) with community members were conducted to learn more about their lifestyles and norms around reproductive health.The respondents for the qualitative interviews were chosen purposively. The quantitative and qualitative data from the study area were collected using pre-tested survey instruments by visiting households between 2020 and 2021, with a brief pause due to the COVID-19-induced lockdown. Only those who voluntarily agreed to be interviewed were

interviewed using an informed consent procedure. Before engaging with the subjects, ethical approval was obtained from the author's institution's Student Research Ethics Committee (SREC), ensuring compliance with ethical guidelines.

Variables

The outcome variable used in the study is "utilization of MHC services," that is, full antenatal care (ANC), institutional delivery, and PNC. Women who had at least four visits for ANC check-ups, received at least one TT injection, and consumed 100+ IFA tablets/syrup for their last birth during the three years preceding the survey were considered to have “full ANC."Institutional delivery is defined as the deliveries conducted in a health facility. In this study, women who went for a check-up at any health facility/doctor within four weeks of delivery are considered to have used PNC services. The predictor variables used in the study are current age (15–24, 25–29, ≥30 years), age at marriage (<18, 18+), children ever born (<3, 3+), education (Illiterate, literate), employment status (not-working, working), usage of tobacco (no, yes), consumption of alcohol (no, yes), media exposure (no, any) of the women and, type of family (nuclear, extended), type of house (kachha, semi-pucca, pucca), distance to the Government health facility (≤5 KM, ≥6 KM), number of ANC visits (one time, two times, three times, four times, none), amount of Iron and Folic Acid (IFA) consumption (<100, 100+), Received two TT injections (yes, no), and standard of living-SLI (low, medium, high) of the household. The Principal Components Analysis (PCA) was used to create the "SLI," a household economic position summary indicator. The current study gathered data on the ownership of durable products, including a Cot, Chair, Pressure cooker, Electric Fan, Radio, Television, Swing machine, Mobile phone, Watch, Bicycle, Motorcycle, and Animal cart, to assess the SLI.

Statistical Analysis

Bivariate analysis was used to understand the relationships between predictors and outcome variables. The adjusted effects of the predictors on utilization of full ANC, institutional delivery, and PNC were examined using binary logistic regression. The predictor variables included in the regression analysis were finalized after the Variable Inflation Factors (VIF)

test was used to check for multicollinearity. Stata (version 16) was used for the analyses with a 5% significance level. Qualitative data was analyzed through NVivo software and verbatim are presented to supplement the quantitative findings in this article, wherever applicable.

Results

Sociodemographic profile of the Juang women

The women interviewed were 26 years old on average (Table 1). Forty-four percent of the women were 15-24 years old, 31% were 25-29, and the rest were 30 and older. About two-thirds of them married below 18 and gave birth to two children. Two-thirds of the women were illiterate, and approximately three-fifths were not employed. The majority of women (89%) live in nuclear families. Almost three-fifths of the women used tobacco and alcohol and had no access to mass media (63%). Notably, 42% of the women had no ANC visit for their last pregnancy, and only 24% had 4+ ANC visits. However, (39%) of the women had consumed 100+ IFA tablets or equivalent syrups. Only (46%) received the recommended two TT injections during their last pregnancy. Three-fifths of the women lived in Kachha houses.

Socioeconomic and demographic differentials in the utilization of MHC services

Only 11% of women had full ANC, 51% had PNC check-ups for their last pregnancy, and 63% of the last deliveries were at an institution (Table 2). Eight percent of those aged 15-24 years, 12% of those aged 25-29 years, and 16% of those 30 and more years had full ANC. A lower percentage of women married below 18 years had full ANC (6% vs. 21%) and institutional delivery (56% vs. 79%) than those married after 18. Of those literates, 19% had full ANC,66% had institutional delivery, and 92% had PNC check-ups. The corresponding figures were 6%, 62%, and 32% for those illiterates. Fourteen percent of those working women had full ANC, and 8% of those were not working. Full ANC, institutional delivery, and PNC check-ups were considerably lower among women consuming tobacco and alcohol than their counterparts. Higher percentages of women exposed to mass media had full ANC (19% vs. 5%), institutional delivery (71% vs. 59%), and PNC (54% vs. 51%) than those not exposed to mass media. Higher percentages of women from the joint family had full ANC (36% vs.7%) and institutional delivery (83% vs. 61%) than those from the nuclear family.

However, PNC check-ups were lower among women from joint families than their counterparts from the nuclear family (46% vs. 53%). Thirty percent of the women from *Pucca* houses received full ANC, compared with 1% from *Kachha* houses. Similarly, 90% of the women from *Pucca* houses than 50% from *Kachha* houses had institutional delivery. A higher percentage of women from high SLI households had full ANC (29% vs. 1%) and institutional delivery (89% vs. 50%) than those from low SLI households. Of those with full ANC, 79% had institutional delivery, and 68% attended PNC check-ups. The corresponding figures were 61% and 51% for those without full ANC. Again, the prevalence of PNC check-ups was higher among those with institutional delivery than their counterparts (55% vs.49%).

Determinants of utilization of MHC services

The data in Table 3 reveals that after controlling variables in the model, illiterate women were less likely to have full ANC (AOR: 0.22) than those literates. The odds of full ANC were also lower among women from low (AOR:0.04) and medium (AOR:0.04) SLI households than their counterparts from high SLI households. The chance of full ANC was lower (AOR: 0.04) among women who reside more than five kilometers from a government health facility than those staying within 5 kilometers. Qualitative data indicate that women generally do not perceive ANC care as essential unless they experience any complications. Moreover, culturally, women are discouraged from disclosing pregnancy until it is self-evident, thus affecting early registration and ANC visits in the first trimester. In the words of an IDI participant,

> *Disclosing the pregnancy is not considered good as there are chances of the evil spirit catching us; my mother-in-law told me not to tell anyone about the pregnancy until it started showing*.

It is also found that the perceived bigger size of the child and the odor of the IFA tablets often deter women from consuming them. To quote a KII participant,

> *When iron tablets are prescribed, they do not take them. They think it will increase the baby's weight. Some say they get a particular smell, so they cannot consume those tablets.*

Women from low (AOR:0.18) and medium (AOR:0.17) SLI households had lower odds of institutional delivery than those from high SLI households. Qualitative data found that increased awareness about healthcare utilization and the financial schemes of the government contribute to institutional delivery. A KII believes that:

> *Nowadays, they (Juang women) know the importance of ANC visits, Institutional delivery, health Schemes, and their monetary benefits, which attracts them to institutional delivery.*

In the words of an IDI participant,

> *ASHADidi (grass-root level health worker) does not come frequently. However, she comes during the delivery time.*

Illiterate women were less likely to have PNC check-ups (AOR: 0.04) than literate women. Qualitative data reveal that illiteracy, preference for traditional health-seeking practices, and distance to the nearest health facility adversely affect the utilization of MHC services. A KII said,

> *Most of the Juang are illiterate, so they cannot easily grasp what the doctors say, and most are hesitant to talk and visit the nearby healthcare facility. They were happy with their world. They prefer traditional practices and health-seeking for everything; visit a hospital, which is about 15-20 km from their village, if the problem is severe. They are staying in the foothills of Gonasika.*

It is also found that poor economic condition compels many to compromise the number of visits to a health facility and the quality of care the women receive, including support from spouses. To quote an IDI participant,

> *We are daily wage laborers; we cannot run our family without daily wages. If my husband comes with me to the hospital, then we will lose Rs. 200/-, which he would have earned otherwise on that day.*

Discussion

The study found that the utilization of MHC services is considerably low among the Juang tribe and has wide variation by literacy level and economic status. Our findings on inadequate utilization of ANC services conform to earlier studies that found low ANC utilization among several tribes (Rani, Ghosh and Sharan, 2007; Deb, 2008; Prusty, Gouda and Pradhan, 2015; Adhikari*et al.*, 2016; Udayar and Parveen, 2020). The reasons include low literacy, poor economic conditions, inadequate awareness, and cultural practices. We found a low prevalence of institutional delivery among the Juang, which is further lower than those tribes in general in the state (Kanrar and Goswami, 2020; IIPS& ICF, 2022) due to geographical isolation and distance to the nearest health facility besides continuing preference for home delivery. The relatively high institutional delivery despite inadequate utilization of ANC services may be due to the proactiveness of Accredited Social Health Activists (ASHA) and to receive financial incentives under the Janani Suraksha Yojana (JSY). The utilization of PNC services is again low. This result agrees with the findings of many past studies conducted across tribes in the country (Sharma *et al.*, 2014; Dehury, Pati and Dehury, 2018). An earlier study in Odisha suggests that the contributing factor to the low use of MHC in regions dominated by tribes is the absence of solid health infrastructure and qualified health workers (Prusty, Gouda and Pradhan, 2015). Another study in Maharashtra suggests the lack of availability, affordability, and accessibility of MHC services among tribal communities, besides unawareness about government schemes such as Janani SurokhyaYojana as the contributory factors (Jungari and Paswan, 2019).

The study found that illiterate Juang women are significantly less likely to utilize MHC services. This finding substantiates many past studies, which document that illiterate tribal women have lower healthcare utilization than their counterparts (Kulkarni and Nimbalkar, 2008; Yadav *et al.*, 2009; Parida, 2010; Adhikari*et al.*, 2016). The poor utilization among illiterate women is due to ignorance of the benefits of healthcare utilization owing to illiteracy (Vijay, 2010; Jose *et al.*, 2014). The poor economic condition of women was another significant predictor for low utilization of MHC services. This finding corroborates the results of many earlier studies (Sanneving et al., 2013; Jose et al., 2014). Our study also found that cultural

factors influence the MHC services of the Juang women. This calls for the provision of customized, culturally appropriate services. A previous study also recommended reorienting MHC services to be responsive to tribal women's needs, to cater to their cultural needs, to support domiciliary deliveries, to invest in building trust with the community, and to preserve beneficial traditional practices (Contractor *et al.*, 2018).

The study was conducted among tribal women with low literacy rates, and data is self-reported; thus, it is susceptible to recall bias. Despite this limitation, to our knowledge, this is the first study that uses a mixed-method approach to investigate MHC utilization among the Juang tribe. Results highlight the level and determinants of MHC services by Juang women and reflect program outreach. Generated evidence is helpful for programs and policies addressing tribal health in general and PVTGs in particular. Collaborative efforts between local healthcare practitioners and NGOs can promote literacy and raise awareness about the significance of MHC services. Policymakers can design programs to boost female literacy, financially support economically disadvantaged families, and establish culturally sensitive healthcare outreach initiatives.

Conclusion

MHC service utilization, critical to combating maternal morbidity and mortality, is low and unevenly distributed among the Juang tribe, with the poor and illiterates being the most disadvantaged.Social norms that discourage early disclosure of pregnancy, perceived adverse effects of IFA, continuing preference for home delivery, ignorance about the importance of PNC, and distance to health facilities are the barriers to the utilization of MHC services. However, ASHA's interaction and efforts are enablers of institutional delivery. These results call for customized culturally appropriate services, specifically targeting socioeconomically disadvantaged women within the Juang tribe. Large-scale healthcare awareness campaigns and the promotion of female literacy are necessary to increase the utilization of MHC services among the Juang tribe.Initiatives should also prioritize enhancing female literacy through community-based education, fostering awareness about the benefits of ANC, institutional delivery, and PNC, and delivering culturally sensitive health services. Collaborative efforts involving local healthcare practitioners, NGOs, and policymakers are

crucial for designing and implementing tailored programs that address the needs of the Juang community. Strengthening program outreach, especially enhancing the interaction with ASHA, would also help enhance the utilization of MHC services among the Juang tribe.

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Table 1: Profile of the Juang women, Odisha, India

Background characteristics	Percent	N
Age group		
15-24 years	44.4	160
25-29 years	31.1	112
≥30 years	24.4	88
Mean age	**26.0**	
Age at marriage		
Below 18	67.5	243
18 and above	32.5	117
Children ever born		
Below 3	66.1	238
Three and above	33.9	122
Education		
Illiterate	66.4	237
Literate	33.4	123
Working status		
Not working	59.2	213
Working	40.8	147
Usage of tobacco		
No	41.9	151
Yes	58.1	209
Consumption of alcohol		
No	40.6	214
Yes	59.4	146
Media exposure		
No exposure	62.6	224
Any exposure	37.4	134
Type of family		

Nuclear	88.6	319
Extended Family	11.4	41
Type of house		
Kachha	60.0	216
Semi-pucca	19.7	71
Pucca	20.3	73
Distance to the Government health facility		
≤5 KM	23.61	85
≥6 KM	76.39	275
Number of ANC visits		
One time	11.94	43
Two times	10.00	36
Three times	11.94	43
Four times	23.89	86
None	42.22	152
Amount of IFA consumption		
<100_IFA	61.39	221
100+IFA	38.61	139
Received two TT injections		
Yes	45.83	165
No	54.17	195
SLI		
Low	34.2	123
Medium	34.2	123
High	31.7	114
Total	**100.00**	**360**

Table 2: Maternal health care utilization by background characteristics of the Juang women, Odisha, India

Background characteristics	Full ANC	Institutional Delivery	Post-natal care	N
Age group				
15-24 years	7.50	59.38	49.38	160
25-29 years	11.61	69.64	53.57	112
≥30 years	15.91	61.36	56.82	88
Age at marriage				
Below 18	5.76	55.56	52.26	243
18 and above	20.51	78.63	52.99	117
Children ever born				
Below 3	10.08	63.87	50.42	238
Three and above	11.48	61.48	56.56	122
Education				
Illiterate	6.33	61.60	32.07	237
Literate	18.70	65.85	91.87	123
Working status				
Not working	7.98	62.91	53.52	213
Working	13.61	63.27	51.02	147
Usage of tobacco				
No	21.19	80.13	54.30	151
Yes	2.87	50.72	51.20	209
Consumption of alcohol				
No	22.60	80.14	54.11	214
Yes	2.34	51.40	51.40	146

Media exposure				
No exposure	5.36	58.93	51.34	224
Any exposure	19.40	70.90	54.48	134
Type of family				
Nuclear	6.90	60.50	53.29	319
Extended Family	36.59	82.93	46.34	41
Type of house				
Kachha	1.39	50.93	50.46	216
Semi-pucca	18.31	71.83	52.11	71
Pucca	30.14	90.41	58.90	73
Distance to the Government health facility				
≤5 KM	35.29	69.41	62.35	85
≥6 KM	2.91	61.09	49.45	275
SLI				
Low	0.81	50.41	47.97	123
Medium	2.44	52.03	58.54	123
High	29.82	88.60	50.88	114
Full ANC				
Yes		78.95	68.42	38
No		61.18	50.62	322
Institutional Delivery				
Yes			54.63	227
No			48.87	133
Total	**10.56**	**63.06**	**51.11**	**360**

Table 3: Determinants of maternal health care utilization among the Juang women, Odisha, India

Background characteristics	Full ANC	Institutional Delivery	Post-natal care
	AOR (CI)	AOR (CI)	AOR (CI)
Age group			
15-24 years®			
25+ years	0.60 (0.18-1.98 -)	1.01(0.57-1.77)	1.31 (0.72-2.40)
Age at marriage			
Below 18®			
18 and above	0.44(0.76-0.62)	1.16 (0.60-2.23)	0.84(0.42-1.69)
Children ever born			
Below 3®			
Three and above	0.95(0.30-2.99)	0.72(0.39-1.30)	1.22 (0.65-2.32)
Education			
Literate®			
Illiterate	0.22** (0.76-0.62)	0.79(0.47-1.33)	0.04***(0.02-0.08)
Working status			
Not working®			
Working	1.89 (0.68-5.21)	1.07(0.65-1.75)	0.81(0.47-1.40)
Usage of tobacco			
Yes ®			
No	1.12 (0.19-6.42)	1.80(0.95-3.42)	0.94(0.45-1.96)
Consumption of alcohol			
Yes®			
No	1.83 (0.28-11.86)	1.09(0.53-2.28)	0.73(0.30-1.76)

Media exposure			
No exposure ®			
Any exposure	0.85 (0.24-3.04)	0.80 (0.45-1.43)	1.31(0.70-2.44)
Type of family			
Nuclear®			
Extended Family	0.77 (0.22-2.73)	0.65(0.21-2.05)	0.59 (0.22-1.59)
Type of house			
Kachha®			
Semi-pucca	1.85(0.26-13.04)	1.05(0.49-2.23)	1.90 (0.80-4.52)
Pucca	3.26(0.43-24.71)	2.52(0.84-7.54)	2.64 (0.88-7.89)
Distance to the Government health facility			
≤5 KM®			
≥6 KM	0.04*** (0.01-0.12)	0.76 (0.40-1.44)	0.59 (0.30-1.17)
SLI			
High®			
Medium	0.04** (0.00-0.29)	0.17**(0.06-0.54)	1.73 (0.54-5.60)
Low	0.04*(0.00-0.67)	0.18**(0.06-0.58)	1.68 (0.52-5.50)
Full ANC			
Yes ®			
No		2.98(0.92-9.65)	1.14 (0.36-3.65)
Institutional Delivery			
Yes®			
No			1.32 (0.73-2.40)

® **Reference category; *, **, *** refers to < 0.05, < 0.01 and < 0.001 level of significance**

Gender-based Seasonal Wage Differentials in India: An Evidence from IHDS Data

Hanumant Waghmare[1] & Arjun Gudakesh[2]*

Abstract

The average wage rates for females are generally lower than those of their male counterparts. Though the gap exists in almost all countries, its intensity varies from one country to another. This paper explores gender-based wage differentials in terms of states and seasons. The present study used the nationally representative Indian Human Development Surveys II (2011-12). This study used Geographic Information System (GIS) techniques to show the geographical presentation of four major types of wage differentials in rabi-kharif, harvesting-sowing, and gender. Kharif and Rabi seasons are divided into three activities: sowing, harvesting, and others, for which women are getting a lower average wage than their male counterparts across the country, except in very few states. In nine states, men and women receive wages ranging from Rs. 100 to 150 for sowing and harvesting during the Rabi season. There is a need to promote employment opportunities for females. However, raising female participation is not the only crucial factor; the level of human capital and workforce composition also matter.

Key words: Wage rates, Gender differentials, India, IHDS data.

Introduction

The average wage rates for females are generally lower than their male counterparts (Agrawal & Vanneman, 2014). Despite substantial improvement in females' participation in the labour market and education, the gender wage gap has lingered in many countries (Chen et al., 2013). Though the gap exists in almost all countries, its intensity varies from one country to another.

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The wage gap is one of the most critical indicators of gender equality in connection with labour market participation (Boll et al., 2016). The wage gap in gender is a concern that has persisted for over a century. Females constitute 48 per cent of India's population, but the share of women in total labour force was 23 percent and labour force participation rate (LFPR) of women (more the 15 years) in India was only 24 per cent in 2014 (Census of India, 2011; ILOSTATS, 2021). This manifests that half of India's potential talent is underused (Zahidi& Ibarra, 2010). There are sharp gender differentials in wage payments. This is partly because women often hold low-level, low-paying positions in female-dominated occupations (Joshi, 2016). Wages and incomes in India have increased over time; however, gender inequalities have not been bridged (Dev, 2002). However, the gender wage gap varies from state to state and season to season (Das et al., 2017).

India is the first developing country to introduce the minimum wage act; as a welfare state, the Indian government has taken steps such as the Minimum Wages Act, 1948; the Payment of Wages Act, 1936; the Payment of Bonus Act, 1965; and the Equal Remuneration Act, 1976. The policy debates have included whether India should enact a national minimum wage floor and, more recently, whether to consolidate the above acts into a single Labour Code on Wages (Papola& Kannan, 2017). The trends in wages are an essential indicator of the welfare of the wage-dependent population, but there are other equally important dimensions to investigate. Article 39 of the Indian Constitution guarantees equal pay for equal work for both men and women. Even though the Indian government has declared several laws to disallow disparities or discrimination against female workers, the gender wage gap still exists.

It is necessary to mention that most of the government interventions mentioned earlier were introduced decades before the liberalization reforms of the 1980s. However, not much has changed regarding the status of women in Indian society and the structure of the labour market. This paper explores the mean gender-based wage differentials by states and seasons.

Methodology

The present study used the nationally representative Indian Human Development Surveys II (2011-12) (IHDS-II). It is part of a collaborative research program between researchers from the National Council of Applied Economic Research and the University of Maryland. It covered all states and union territories of India except Lakshadweep Andaman Nicobar

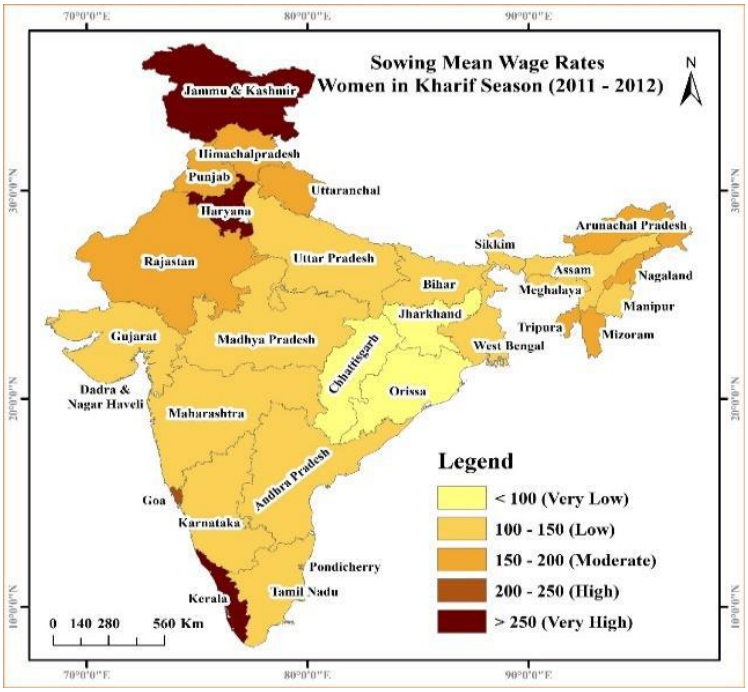
Island. The India Human Development Survey-II (IHDS-II), 2011-12, is a multi-topic survey of 42,152 households in 1,503 villages and 971 urban neighborhoods across India. These data are mostly re-interviews of households interviewed for IHDS-I (ICPSR 22626) in 2004-05. This survey collects information on health, education, employment, economic status, marriage, fertility, gender relations, and social capital. This survey aims to document changes in the daily lives of Indian households in a society undergoing rapid transition. The study used Geographic Information System (GIS) technique to show the geographical presentation of four major types of wage difference rates in rabi-kharif, harvesting-sowing, and gender.

The Indian cropping season is classified into two main seasons - (1) Kharif and (2) Rabi based on the monsoon. The Kharif cropping season is from July to October during the southwest monsoon, and the Rabi cropping season is from October to March (winter). Pakistan and Bangladesh are other countries that use the terms 'kharif' and 'rabi' to describe their cropping patterns. The terms 'kharif' and 'rabi' originate from Arabic, where Kharif means autumn and Rabi means spring. The Kharif crops include rice, maize, sorghum, pearl millet/bajra, finger millet/ragi (cereals), arhar (pulses), soybean, groundnut (oilseeds), cotton, etc. The rabi crops include wheat, barley, oats (cereals), chickpea/gram (pulses), linseed, and mustard (oilseeds) (Srija, 2011).

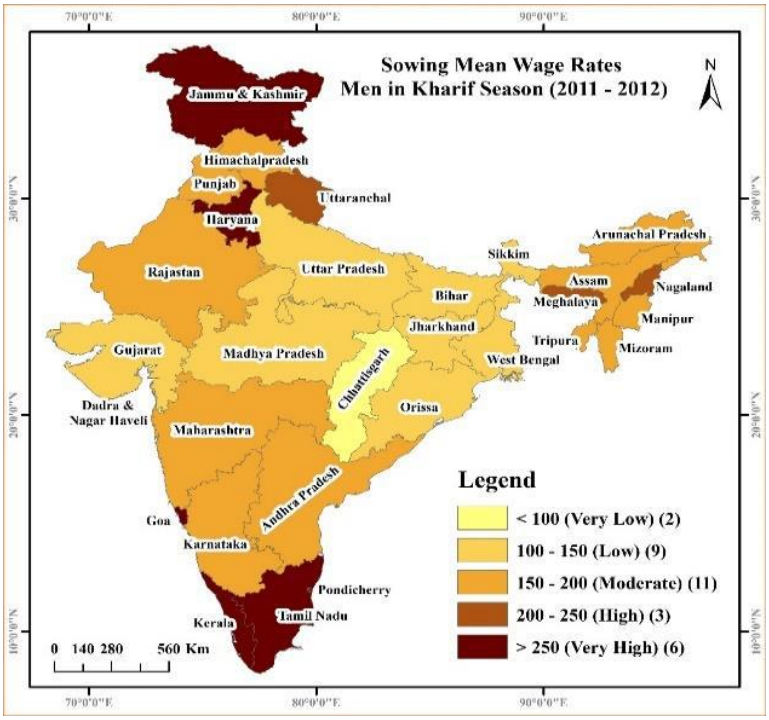
Result

Sowing wage rates in Kharif season

Maps 1 and 2 show the state-wise mean wage rates of women and men during the Kharif season in the 2011-2012 period. In wage distribution, there is a gap between males and females. In six states (Kerala, Jammu Kashmir, Haryana, Tamil Nadu), men get above 250 rupees during the Kharif season. At the same time, only three states have women receiving above 250 rupees, namely Kerala, Jammu Kashmir, and Haryana. In states like Orissa, Chhattisgarh, and Jharkhand, women earn below 100 rupees, a meagre wage during the Kharif season. Map 1 shows that most women earn 100-150 rupees during the Kharif season, whereas most men get wages between 150-200 rupees.



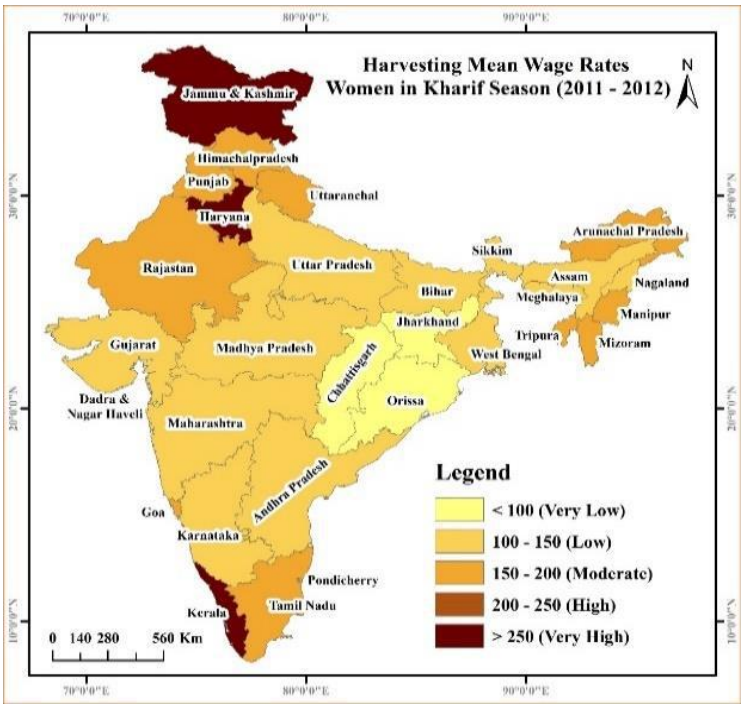
Map 1: Mean sowing wage rates of women in Kharif season, 2011-12



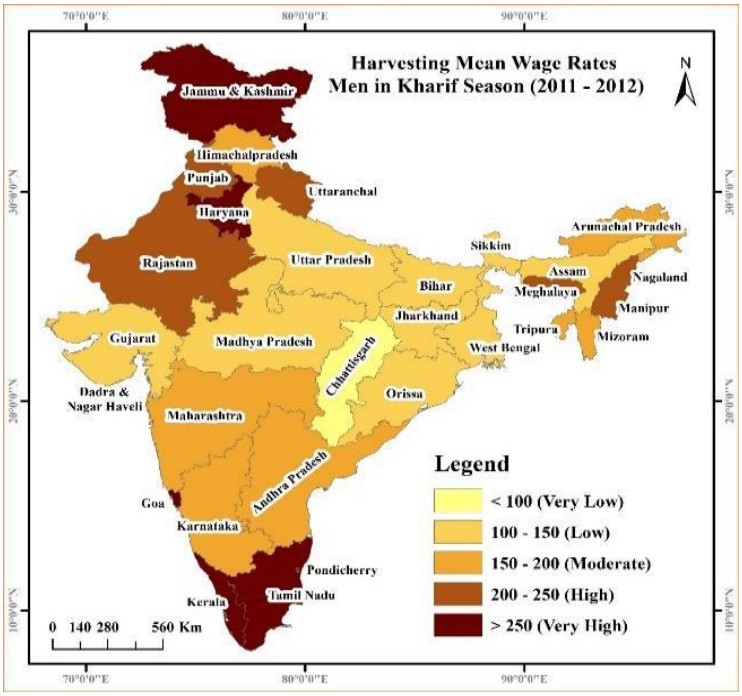
Map 2: Mean sowing wage rates of men in Kharif season, 2011-12

Harvesting wage rates in Kharif season

Maps 3 and 4 portray the harvesting wage rates for women and men during the Kharif season. In only one state, Chhattisgarh, men earn below 100 rupees as harvesting wages during the Kharif season. In Jammu Kashmir, Kerala, Haryana, and Tamil Nadu, men earn above 250 rupees for harvesting during this season. Similarly, in Kerala, Haryana, and Jammu Kashmir, women get an equal wage (above 250 rupees) for harvesting. Conversely, women in Orissa, Jharkhand, and Chhattisgarh earn very low harvesting wages compared to their male counterparts. The comparison of both maps gives a clear picture of gender discrimination in wage distribution. The majority of women earn 100-150 rupees as harvesting wages during the Kharif season, whereas the majority of men earn harvesting wages between 150-200 rupees.



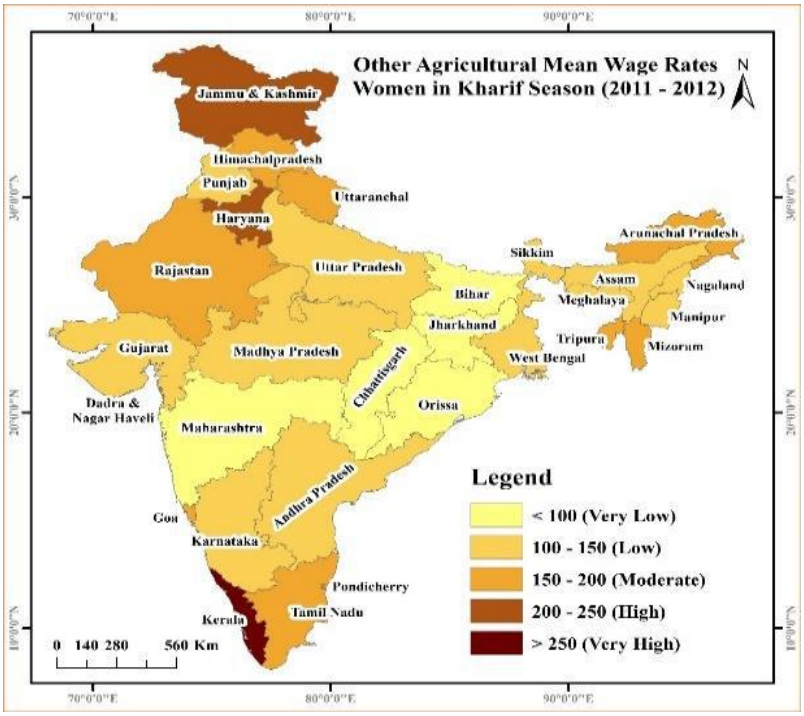
Map 3: Mean harvesting wage rates of women in Kharif season, 2011-12



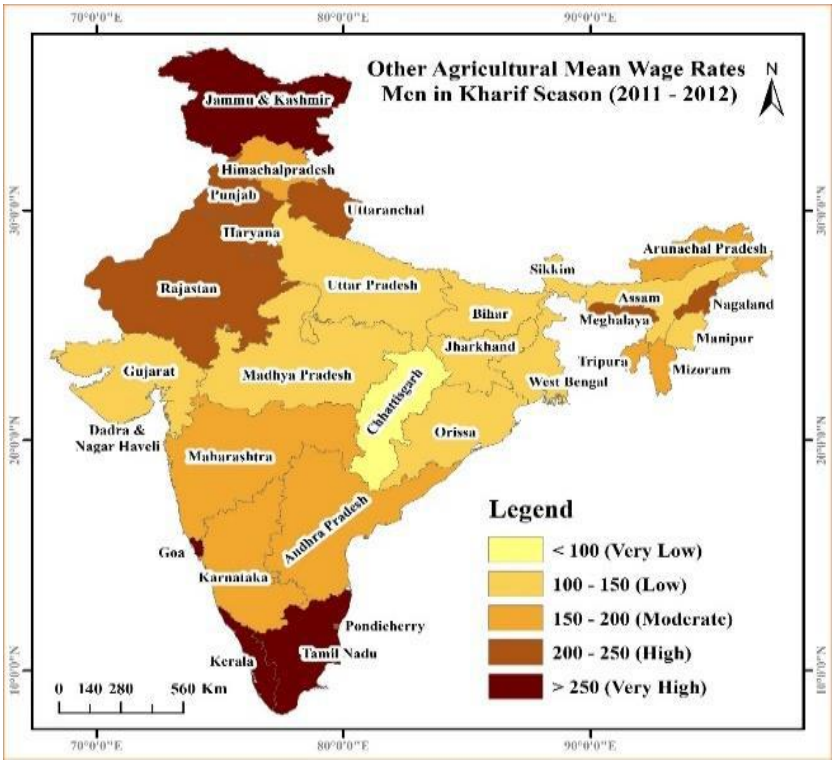
Map 4: Mean harvesting wage rates of men in Kharif season, 2011-12

Other wage rates in Kharif season

Maps 5 and 6 illustrate the wage rates for women and men in activities other than harvesting during the Kharif season. Compared to women, men receive higher wages in almost all states. Kerala is the only state providing the highest wages to both men and women. Women get the lowest wages (less than 100 rupees) in four states, i.e., Maharashtra, Orissa, Chhattisgarh, and Jharkhand, whereas men in Chhattisgarh earn the lowest wages.



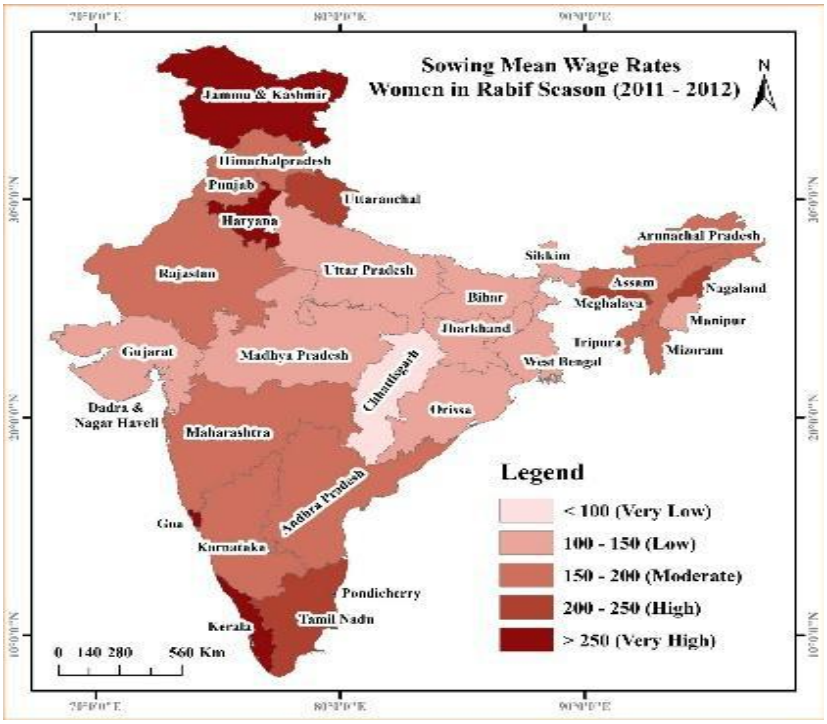
Map 5: Mean wage rates of women in other than harvesting in Kharif season, 2011-12



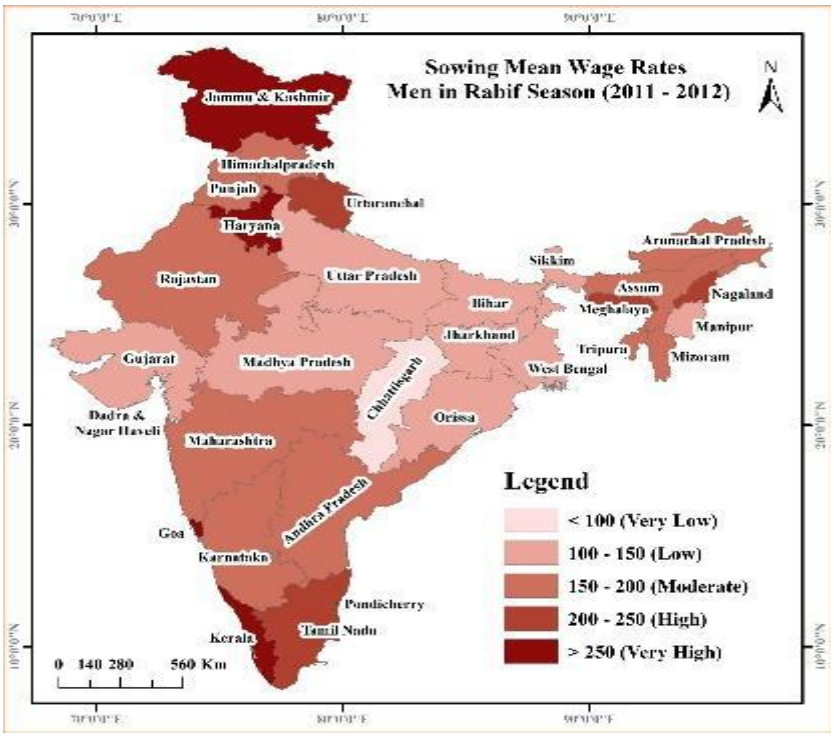
Map 6: Mean wage rates of men in other than harvesting in Kharif season, 2011-12

Sowing wage rates in Rabi season

Maps 7 and 8 depict the wage distribution of women and men during the Rabi season. The sowing wage patterns for women and men are nearly identical across all states in India. However, in Chhattisgarh, men and women get the lowest wages (less than 100 rupees) during the Rabi season. In nine states, both men and women earn low wages (100-150 rupees). Notably, in three states (Jammu and Kashmir, Haryana, and Kerala), men and women receive the highest sowing wages (more than 250 rupees).



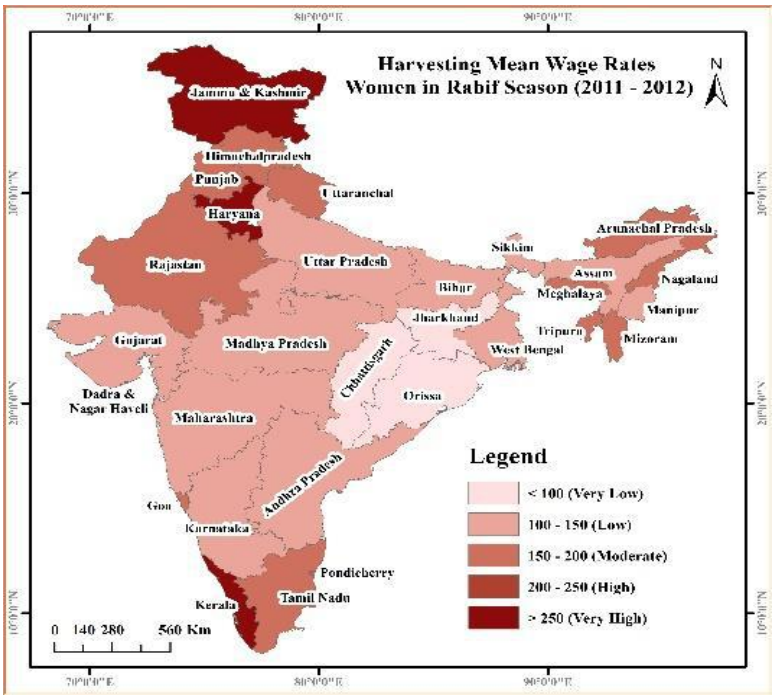
Map 7: Mean sowing wage rate of women in Rabi season, 2011-12



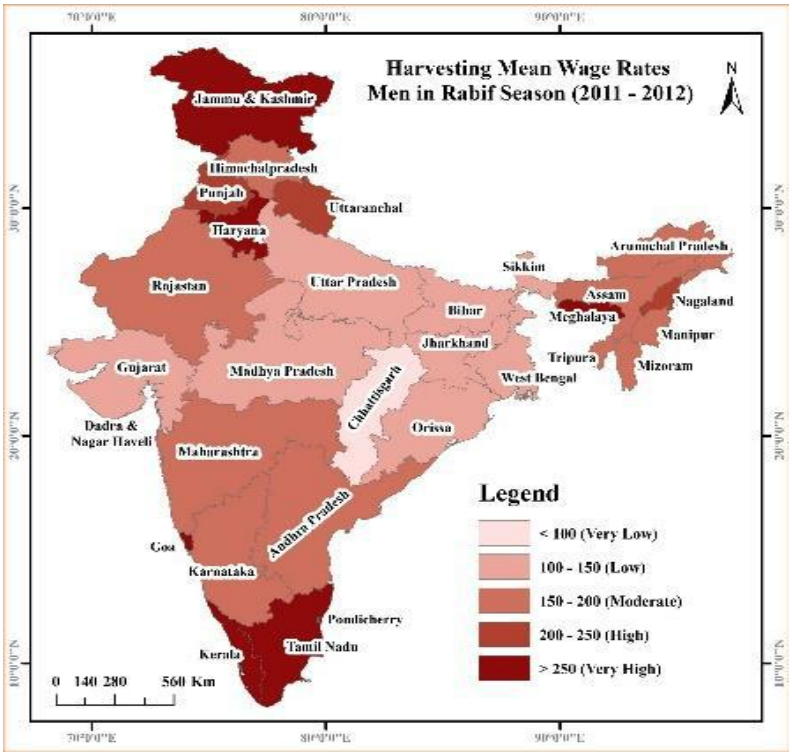
Map 8: Mean sowing wage rate of men in Rabi season, 2011-12

Harvesting wage rates in Rabi season

Maps 9 and 10 show the mean wage rates for harvesting during the Rabi season for women and men. In Kerala, Meghalaya, and Jammu Kashmir, men and women receive wages above 250 rupees. However, only men earn wages above 250 rupees in Tamil Nadu and Haryana. Conversely, in Chhattisgarh, Orissa, and Jharkhand, women earn the lowest wages (less than 100 rupees). Across most states, men earn moderate wages (150 to 200 rupees) during the Rabi season.



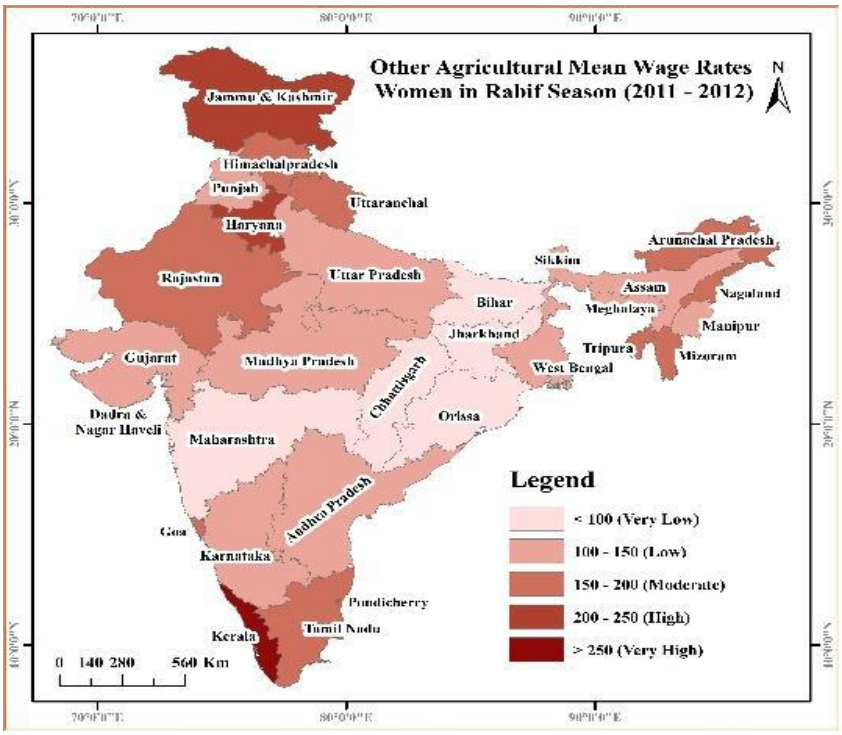
Map 9: Harvesting mean wage rate in Rabi season for women, 2011-12



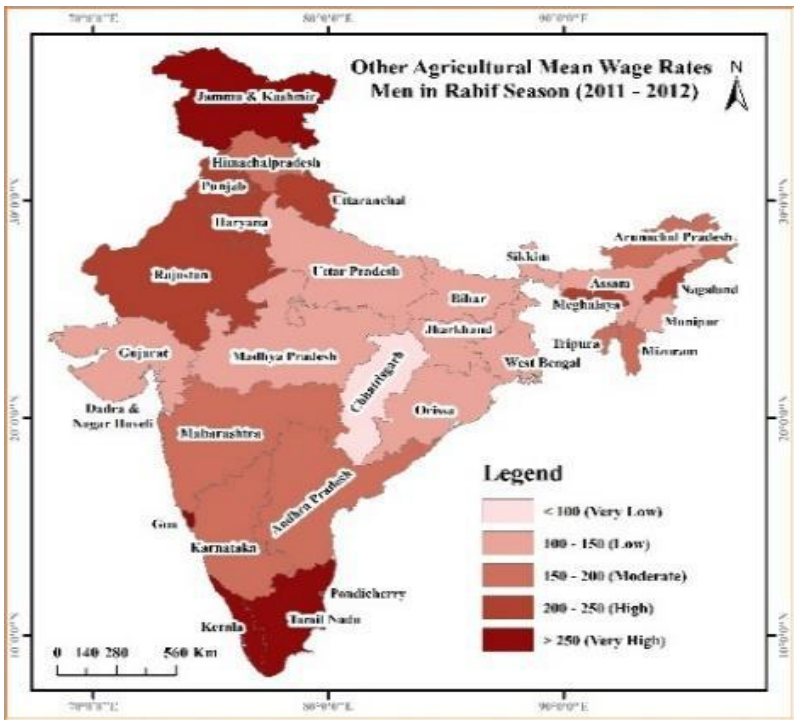
Map 10: Harvesting mean wage rate in Rabi season for men, 2011-12

Other wage rates in Rabi season

Maps 11 and 12 present the wage rates for activities other than sowing and harvesting during the Rabi season for men and women. Kerala stands out as the only state where both men and women receive wages exceeding 250 rupees. In contrast, in Tamil Nadu and Jammu Kashmir, only men earn wages above 250 rupees. Notably, Chhattisgarh is the sole state where men receive the minimum wages, while women in Maharashtra, Orissa, Bihar, and Chhattisgarh also earn the lowest wages.



Map 11: Wage rates of women in other than harvesting in Rabiseason, 2011-12



Map 12: Wage rates of women in other than harvesting in Rabi season, 2011-12

Discussion and Conclusion

This paper investigates wage inequalities in agricultural activities among Indian states, with a specific focus on the male and female wage gap. The findings highlight regional disparities, indicating that certain northern and southern states experience higher wages compared to other parts of the country. The study categorizes both Kharif and Rabi seasons into three activities—sowing, harvesting, and others—revealing that women consistently receive lower average wages than their male counterparts across the nation, a pattern consistent with previous studies (Agrawal &Vanneman, 2014). Notably, Chhattisgarh emerges as the sole state with very low wage rates, less than Rs. 100 during both the Kharif and Rabi seasons in 2011-12.

In India, approximately nine states witness both men and women earning wages ranging from Rs. 100 to 150 for sowing and harvesting during the Rabi season, followed by Jammu and Kashmir, Haryana, and Kerala, where wages exceed Rs. 250. However, these rates exhibit

gender-based variations attributed to discrimination based on gender and caste. The wage differential between males and females is primarily attributed to discriminatory practices in the labour market (Agrawal, 2014).

Overall, the study underscores that only select northern and southern states exhibit marginally better wage rates for agricultural activities compared to the rest of the country. States such as Kerala, Jammu Kashmir, Haryana, and Tamil Nadu receive wages exceeding Rs. 250 for agricultural activities, while states like Orissa, Chhattisgarh, and Jharkhand witness women earning less than 100 rupees, signifying a significant disparity.

The seasonal wage gap between males and females is very high and ranges from Rs. 250 to Rs. 100. Despite overall wage growth in India, the gender wage differential persists, a phenomenon attributed to discriminatory patterns and lower bargaining power among female workers (Joshi & Kumara, 2018). In India, wage and income have been rising over the period but gender wage differential and inequalities have not been bridged (Dev, 2002; Jose, 1987). Skill enhancement, particularly among vulnerable and underprivileged women, is crucial to reducing gender wage differentials.

The policy implications of the findings emphasize the need to promote female employment opportunities. However, increasing female participation alone is insufficient; improvements in human capital and workforce composition are also vital. The Indian Constitution already upholds the principle of "equal pay for equal work" under Article 14 which states that "the State shall not deny to any person equality before the law or equal protection of the laws within the territory of India". Further Article 39(d) reinforces this commitment, “the State shall, in particular, direct its policy towards securing: that there is equal pay for equal work for both men and women” (Deakin & Sarkar, 2011).

Additionally, the Equal Remuneration Act, 1976, aims to prevent gender discrimination by mandating equal remuneration for men and women for the same or similar work. Strict implementation of these legislations in workplaces is imperative. In this regard, the Act has two main provisions: (i) a duty of the employer to pay equal remuneration to men and women for same work or work of a similar nature, and (ii) no discrimination to be made while

recruiting men and women workers (Agrawal&Vanneman, 2014).All these legislation needs to be implemented more strictly. Finally, study sheds light on the neglected area of research regarding the impact of childcare activities on female participation and wages in developing countries, particularly in a context like India which has a low female workforce participation rate. This avenue deserves special attention for comprehensive policy considerations.

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Association of Leisure Activity Participation and Perceived Life Satisfaction among Elderly: Evidences from Longitudinal Ageing Study in India Wave-1

Nidhi Bansal[1] & Jagatpal Singh[2]

Abstract

Amidst India's demographic evolution towards an aging population, this study taps into the Longitudinal Ageing Study in India (LASI) Wave-1 data, focusing on elderly individuals aged 60 and above, to investigate the link between leisure activities and life satisfaction. The research employs multinomial logistic regression, adjusting for demographic variables, to discern the impact of various leisure activities on life satisfaction. It emerges that indoor activities, notably reading (RRR: 1.537, 95% CI: 1.334-1.756) and internet use (RRR: 1.557, 95% CI: 1.220-1.977), significantly enhance the likelihood of high life satisfaction. Outdoor activities like sports or yoga are positively associated with life satisfaction, though to a lesser extent (RRR: 1.090, 95% CI: 0.950-1.253). Social activities exhibit diverse effects: visiting friends or relatives monthly and attending religious activities weekly are related to higher odds of experiencing high life satisfaction, in contrast to activities like attending political/community meetings or frequently visiting the cinema, which do not show a significant association.

The study underscores the need for policy and intervention strategies that are sensitive to the cultural and contextual specificities of India's elderly population. By promoting access to a range of leisure activities, especially those fostering cognitive engagement, policymakers can enhance opportunities for active ageing among Indian elderly. The research points to the importance of developing inclusive and diverse leisure opportunities, advocating for the development of elderly-friendly environments and digital literacy awareness, which may be vital for a holistic approach to elderly welfare in India.

Key words: Elderly, Leisure Activity Participation, Life Satisfaction, Activity Theory

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Introduction

India's demographic landscape is undergoing a significant shift, marked by an increasing focus on aging and its implications for successful aging. This phenomenon encompasses a broad spectrum of factors, including demographic, social, economic, and health-related aspects, and gives rise to various dimensions such as health, well-being, life satisfaction, active participation, and social connectedness. Theories in aging and gerontology, such as Activity Theory (Havighurst, 1961), suggest a strong link between leisure activity engagement and life satisfaction in the elderly, positing that active participation in both physical and intellectual activities contributes significantly to overall well-being.This theory has been supported by various studies. For example, Steinkamp& Kelly (1987) found that engagement in leisure activities contributed to life satisfaction through both objective and subjective aspects of social integration.

However, in the Indian context, the systematic investigation of this theory has been limited, as noted by Sharma, Clune, & Blair (2016) and Srivastava (2014), who highlight the need for social innovation and governmental involvement in promoting active aging.

Research in other countries, like Yoon, Lee, et al. (2020) in South Korea, has shown significant associations between leisure activities and life quality in the elderly. Griffin and McKenna (1998) also found a relationship between the nature of leisure activities and life satisfaction, though they noted that satisfaction can remain high even with reduced activity diversity. Cha (2018) emphasized the positive effects of outdoor leisure activities on life satisfaction, suggesting the importance of national policies to encourage such involvement. Ragheb & Griffith (1982) further confirmed the positive correlation between leisure activity frequency and life satisfaction. Similarly, Rodríguez et al. (2008) found a positive relationship between activity engagement and life satisfaction, consistent with Activity Theory.

In India, as older adults' living options evolve (Winstead, Yost, Cotten, et al., 2017), it becomes crucial to understand how leisure activities can redefine aging identity and impact quality of life. Kelley et al. (2014) and Reitzes et al. (1995) highlighted the significance of maintaining an active lifestyle for self-esteem and self-evaluation among the elderly. Okamoto (2008) further demonstrated the varying impacts of different social activities on life

satisfaction among elderly individuals in Japan, showing a gender difference in the types of activities that lead to increased satisfaction.

This study aims to explore the association between leisure activity participation and perceived life satisfaction among the elderly in India, building upon the framework of Activity Theory. It seeks to examine how changes in leisure activity frequency correlate with perceived life satisfaction, thus contributing to the broader discourse on successful aging and the role of leisure activities.

Methodology

Data

The current research employs data from the first wave of the Longitudinal Ageing Study in India (LASI), a comprehensive, nationally representative survey encompassing more than 73,000 individuals aged 45 and above from all states and union territories of India. Specifically, this study focuses on a subset of the LASI dataset, examining a sample of 30,341 elderly participants aged 60 years and older.

Outcome variable

The study focuses on the outcome variable of "life satisfaction" among older adults. To assess life satisfaction, participants were asked to respond to five statements related to their overall life evaluation. These statements included assessing the proximity of their life to an ideal state, the excellence of their life conditions, their satisfaction with life, the attainment of important things in life, and their desire to change anything if given the opportunity to live again. Responses were provided on a seven-category scale ranging from "strongly disagree" to "strongly agree." National data were used to construct a life satisfaction scale, where scores between 5 and 20 were categorized as "low satisfaction," scores between 21 and 25 as "medium satisfaction," and scores between 26 and 35 as "high satisfaction."

Predictor variables

To explore the factors related to life satisfaction, the study considered a range of demographic, social, and economic variables. These variables included age, gender, marital status, place of residence, caste, religion, and wealth quintile. Additionally, the study

examined the participation in 11 different leisure activities, which were grouped into four categories: outdoor/active activities (such as visiting parks/beaches and engaging in outdoor sports/exercise), social activities (such as visiting relatives/friends and attending cultural or religious events), indoor/passive activities (such as reading books/magazines, watching television/listening to the radio, and using a computer), and other activities (such as eating out). The frequency of participation in each activity was assessed based on three categories: "rarely/never," "at least once a week," and "at least once a month."

Statistical analysis

The preliminary findings were presented using descriptive analysis and bivariate analysis. To examine the variations in life satisfaction and assess their statistical significance, the proportion test was employed. Additionally, multinomial logistic regression was used to investigate the odds of higher life satisfaction among elderly individuals in India based on their participation frequency in active, social, and passive leisure activities. The general form of the multinomial logistic regression model is expressed as:

$$\log\left(\frac{P(Y=j)}{P(Y=r)}\right) = \beta_{0j} + \beta_{1j}X_1 + \beta_{2J}X_2 + \ldots + \beta_{kj}X_k$$

where, P(Y=j) is the probability of the dependent variable (life satisfaction) being in category j (medium or high satisfaction), P(Y=r) is the reference category probability (low satisfaction), $\beta_{0j}, \beta_{1j}, \ldots \beta_{kj}$ are the coefficients to be estimated for category j, $X_1, X_2, \ldots X_k$ represent the independent variables (e.g., age, gender, frequency of participation in leisure activities).

In our multinomial logistic regression analysis, the results are presented as Relative Risk Ratios (RRRs). These ratios are a measure of the change in the odds of the outcome (in our case, levels of life satisfaction) occurring for a one-unit change in the predictor variable, holding other variables constant. An RRR greater than 1 indicates an increased likelihood of the outcome (e.g., higher life satisfaction) occurring with an increase in the predictor variable. Conversely, an RRR less than 1 suggests a decrease in the likelihood of the outcome with an increase in the predictor variable. An RRR of 1 implies no change in the odds. By using this approach, we have determined the relative impact of frequency of leisure activity

participation, on the likelihood of an elderly individual reporting different levels of life satisfaction.

Results

Table 1 provides information on various background characteristics of the study participants categorized by age groups. A noticeable majority can be seen to (65.8%) reside in rural areas. This rural predominance was more pronounced in the older age groups. The sample displayed a balanced gender distribution with a marginal female majority (52.1%), which became more apparent in the Octogenarian and Nonagenarian groups.

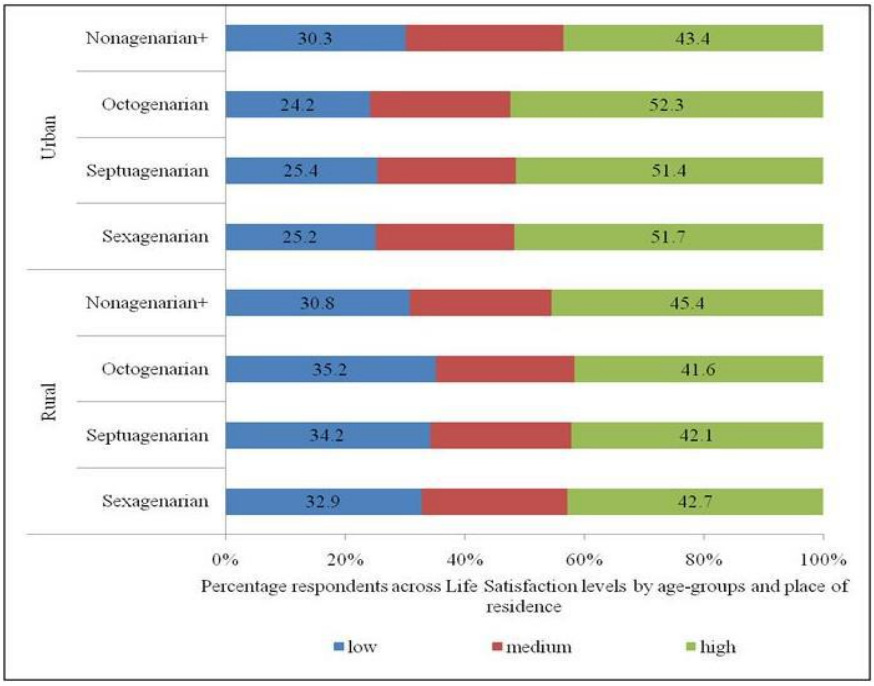
Regarding marital status, a significant shift was observed with age: 71 percent of Sexagenarians were married, in contrast to only 19 percent among Nonagenarians, where widowed individuals constituted the majority. The sample was predominantly Hindu (73.2%). Educational levels were low across all age groups, with no schooling reported in 79 percent of the oldest age bracket. Aligning with the common expectations, employment status revealed a downward trend with age, with active employment dropping from 36 percent in the 60-69 age group to just 4% in those 90 and above. Economically, the distribution was relatively even across Monthly Per Capita Consumption Expenditure (MPCE) quintiles, though minor variations existed between different age groups.

Table 1: Percentage distribution of elderly aged 60 and above across 10 year age-groups, by background characteristics

Background Characteristics	Age Groups				Total
	60-69	70-79	80-89	90+	
Place of residence					
Rural	65.93	65.15	66.38	74.59	**65.87**
Urban	34.07	34.85	33.62	25.41	**34.13**
Sex of Respondent					
Male	47.20	50.17	48.82	42.08	**47.99**
Female	52.80	49.83	51.18	57.92	**52.02**
Current Marital Status					
Currently Married	70.55	53.56	34.32	19.13	**63.31**
Widowed	26.69	44.22	62.76	79.24	**34.07**
Other	2.76	2.23	2.92	1.64	**2.62**
Religion					
Hindu	73.58	73.36	69.85	69.13	**73.22**

Muslim	12.26	10.94	11.21	12.02	**11.86**
Christian	9.42	10.52	13.19	15.03	**10.01**
Others	4.75	5.19	5.75	3.83	**4.91**
Caste Category					
Scheduled caste	17.72	15.64	14.10	12.11	**16.90**
Scheduled tribe	17.06	16.39	18.16	20.56	**17.01**
Other Backward Class	39.36	38.57	37.84	40.56	**39.08**
None of them	25.86	29.41	29.91	26.76	**27.02**
Level of Education					
No schooling	51.79	55.45	61.77	78.69	**53.68**
<5 years complete	11.34	13.17	14.93	9.84	**12.02**
5-9 years complete	20.63	17.00	13.56	9.56	**19.12**
≥10 years complete	16.25	14.38	9.75	1.91	**15.18**
Work Status					
Currently working	36.72	17.62	6.69	3.56	**29.59**
Previously worked	35.77	54.41	62.93	62.19	**42.51**
Never worked	27.52	27.97	30.38	34.25	**27.90**
MPCE quintile					
Poorest	20.72	20.57	19.96	18.85	**20.61**
Poorer	20.80	20.21	19.96	19.67	**20.59**
Middle	20.32	20.51	19.92	25.14	**20.39**
Richer	19.36	19.93	21.14	18.58	**19.61**
Richest	18.81	18.78	19.02	17.76	**18.81**

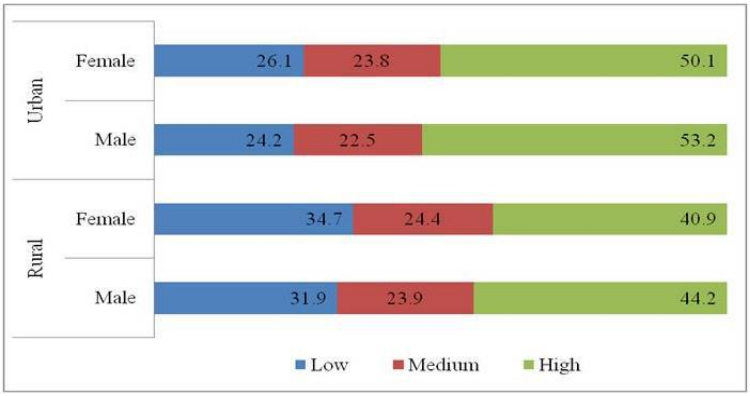
Figure 1: Percentage of elderly across Life Satisfaction levels by age Residence, and age



Building on the demographic overview of the elderly in India, Figures 1 and 2 delve deeper into the nuances of life satisfaction among these individuals across different settings and demographic segments.

Figure 1 shows that in urban areas, slightly more than half the surveyed elderly across all age groups have reported high life satisfaction. Among urban elderly, highest proportion of 'low life satisfaction' reporting is attributed to the Nonagenarians (30.3%). Urban elderly reporting of high level of life satisfaction remains fairly consistent across all groups, peaking among octogenarians and observing lowest share among nanogerains.

Figure 2: Percentage of elderly across Life Satisfaction levels by Residence, and sex



In Figure 2, which examines life satisfaction by place of residence and gender, a distinct pattern emerges. In urban settings, a higher proportion of elderly males (53.2%) report high life satisfaction than their female counterparts (50.1%). This pattern holds in rural areas, where elderly males again report a higher percentage of high life satisfaction (44.2%) compared to elderly females (40.9%). Additionally, urban elderly, as a group, demonstrate a greater proportion of high life satisfaction relative to rural elderly.

Table 2: Percentage distribution of elderly across perceived levels of life satisfaction, by frequency in leisure-activity participation

Activity Category	Leisure Activity	Participation Frequency	Life Satisfaction		n	χ^2
			Low	High		
Outdoor activities	Go to park/beach for relaxing	At least once a week	19.77	57.09	769	
		At least once a month	27.77	52.21	839	
		Rarely/Never	30.95	45.11	28733	70.014*
	Play out door games/sports/	At least once a week	23.19	56.31	1673	
		At least once a month	28.84	43.94	1113	91.214*

	exercise/ yoga	Rarely/Never	31.09	45.03	27555	
Social Activities	Visit relatives /friends	At least once a week	29.42	46.9	3872	
		At least once a month	26.62	49.09	9034	
		Rarely/Never	32.88	43.52	17435	121.554*
	Attend cultural show or Cinema	At least once a week	35.28	39.8	598	
		At least once a month	29.68	44.74	1833	
		Rarely/Never	30.53	45.79	27910	12.733*
	Attend religious functions	At least once a week	26.86	49.58	3596	
		At least once a month	28.45	47.67	4454	
		Rarely/Never	31.6	44.56	22291	52.535*
	Attend political/community meetings	At least once a week	35.23	41.56	474	
		At least once a month	28.92	45.82	1231	
		Rarely/Never	30.57	45.67	28636	7.398*
Indoor/ Education /Media-related activities	Read books/newspapers	At least once a week	19.29	59.87	6397	
		At least once a month	28.36	47.73	1192	
		Rarely/Never	33.87	41.49	22752	750.363*
	Watch television/listen radio	At least once a week	25.89	50.68	17381	
		At least once a month	34.98	37.5	1744	
		Rarely/Never	37.15	39.02	11216	535.763*
	Use a computer for net surfing	At least once a week	16.51	68.69	757	
		At least once a month	27.47	41.39	273	
		Rarely/Never	30.97	45.05	29311	175.101*
	Play cards or indoor games	At least once a week	38.46	41.94	403	
		At least once a month	34.32	39.86	577	
		Rarely/Never	30.39	45.78	29361	20.684*
Total			**29.74**	**44.79**	**30341**	

Note: *: chi-square significance level at p<0.001

Expanding to study the relationship between life satisfaction and leisure activity participation among the elderly, Table 2 outlines a complex interplay. For outdoor activities, a majority of the elderly who visit parks or beaches (57.09%) or partake in sports or yoga (56.31%) at least weekly report high levels of life satisfaction, reflecting a significant trend.

The domain of social activities presents a complex picture. Regularly visiting relatives or friends correlates with a high life satisfaction (46.9%). However, a notable counter-pattern is observed where infrequent participation in activities such as attending cultural performances aligns with an even greater proportion of high life satisfaction. With regards to Indoor and media-related pursuits, a substantial 59.8% of seniors engaging in reading weekly report high life satisfaction, with the highest proportion (68.7%) associated with those using computers

weekly. Contrastingly, the data indicates that infrequent participation in certain indoor activities, like playing cards, is associated with a larger share of seniors reporting high life satisfaction (45.8% for rarely/never) as compared to those participating weekly (41.9%).

To reflect how various demographic and socio-economic correlates associate with leisure activity participation among elderly in India, Table 3 presents the proportion of elderly individuals engaged in at least one outdoor, social, or indoor leisure activity at least once a week, delineated by various background characteristics. Overall, 7% of the elderly engage in outdoor activities, 21.89% in social activities, and 59.10% in indoor/media/educational activities weekly.

A breakdown by residence shows urban elderly are more likely to engage in all categories of leisure activities compared to their rural counterparts, with significant differences particularly in outdoor (12.77% urban vs. 4.03% rural) and indoor activities (80.72% urban vs. 47.99% rural). A gendered pattern in leisure activity preferences or opportunities is also indicated as males are more active in all three categories than females, with the most considerable gap in outdoor activities (9.28% for males vs. 4.90% for females). This pattern persists across marital status, living arrangements, and religious affiliations, each presenting distinct participation rates.

Notably, those living alone are less likely to engage in any leisure activity category compared to those living with spouses, children, or others. This trend is particularly pronounced in indoor activities, where only 39.81% of those living alone engage weekly compared to 64.45% living with a spouse and children. Educational attainment shows a clear positive correlation with participation rates. Individuals with higher education are significantly more likely to engage in all types of leisure activities, especially indoor activities where participation jumps to 88.75% for those with ≥10 years of education. Work status also influences engagement, with those currently working showing moderate participation rates across activities, while those who have never worked report lower rates in outdoor and social activities.

Table 3: Proportion of elderly engaging in at least one leisure activity under the corresponding categories - 'Outdoor', 'social', and 'indoor'- at least once a week, by background characteristics

Background Characteristics		Participation in at least one activity under the corresponding categories at least once a week					
		Outdoor		Social		Indoor/Media/ Educational	
		%	χ^2	%	χ^2	%	χ^2
Residence	Rural	4.03	*815.27*	19.68	*172.46*	47.99	*3.103**
	Urban	12.77	*	26.19	*	80.72	
Sex	Male	9.28	*228.56*	23.85	*64.34**	62.09	*105.35**
	Female	4.90	*	20.08		56.35	
Marital Status	Currently Married	8.12	*105.54*	23.43	*79.44**	62.30	*247.49**
	Widowed	4.97	*	18.98		53.00	
	Other	6.25		22.43		61.27	
Living Arrangem-ents	Living alone	4.45	*118.26*	19.00	*124.19*	39.81	*479.05**
	Spouse only	7.14		20.36		57.82	
	Spouse and children	8.58	*	24.81	*	64.45	
	Children only	5.28		19.71		56.88	
	Others only	4.76		17.52		50.18	
Religion	Hindu	7.28	*80.12**	17.14	*1.403**	59.24	*77.03**
	Muslim	7.36		30.74		53.43	
	Christian	3.36		43.85		62.62	
	Others	9.39		26.25		63.49	
Caste	Scheduled caste	5.03	*233.06*	14.82	*693.63*	50.84	*762.81**
	Scheduled tribe	4.96	*	34.35	*	48.94	
	OBC	6.37		18.59		58.93	
	None of the above	10.64		22.69		70.07	
Education	No schooling	3.25	*1.50**	17.48	*444.15*	43.50	*4.103**
	<5 years complete	6.32		27.63	*	67.95	
	5-9 years complete	8.31		24.75		74.03	
	≥10 years complete	19.21		29.39		88.75	
Work Status	Currently working	5.85	*89.10**	24.13	*61.57**	57.40	*16.45**
	Previously Worked	8.59		22.03		59.56	
	Never worked	5.79		19.28		60.19	
MPCE Quintile	Poorer	4.91	*193.85*	17.89	*166.66*	44.88	*963.90**
	Poor	5.46		19.50		55.37	
	Middle	6.47	*	22.76	*	61.59	
	Richer	7.88		23.12		64.80	
	Rich	10.63		26.66		70.16	
Total		**7.00**		**21.89**		**59.10**	

Note: *: chi-square significance level at p<0.001

Finally, the MPCE quintile demonstrates a gradient in leisure activity participation; as economic status improves, so does engagement in all activity types, particularly in indoor activities where the richest quintile shows a 70.16% participation rate.

The observed differences in weekly participation rates in at least one leisure activity, based on residence, gender, marital status, living arrangements, religion, caste, education, work status, and MPCE quintiles, are statistically significant with chi-square tests yielding p-values less than 0.001.

To extend on the earlier discussion of leisure activity participation and its association with life satisfaction, the analysis now turns to the multinomial regression results detailed in Table 4. It breaks down the relationship between the frequency of specific leisure activities and life satisfaction.

The multinomial logistic regression analysis from Table 4 provides a detailed look at how different leisure activities influence the likelihood of elderly individuals reporting high versus low life satisfaction. The tabulated relative risk ratios signify the predictive multiplicative change in the relative likelihood, i.e., the likelihood of an elderly falling into a comparison group(medium, high life satisfaction), relative to the likelihood of falling into the baseline group(low life satisfaction). An RRR value of greater than 1 indicates an increased likelihood of an elderly falling into the comparison group, i.e. perceiving life satisfaction as either medium, or high. The analysis includes various leisure activities and compares the frequency of participation (at least once a month versus at least once a week) to two comparisons: low versus medium levels of life satisfaction and low versus high levels of life satisfaction.

The analysis reveals a significant relationship between several leisure activities and life satisfaction, after controlling for various social and demographic factors. Notably, engaging in certain activities on a weekly basis, such as reading and internet use, shows a strong positive association with high life satisfaction, with Relative Risk Ratios (RRRs) of 1.537 and 1.557, respectively, and confidence intervals indicating statistical significance. Other activities, such as watching television or listening to the radio, also demonstrate a significant positive correlation with high life satisfaction (RRR: 1.256).

Frequent visits to parks are statistically associated with significantly higher odds of high life satisfaction among the elderly, compared to infrequent or no visits (RRR: 1.546). While engaging in outdoor games or physical exercise also suggests increased odds of higher life satisfaction, these associations do not reach statistical significance.

Table 4: Multinomial regression results: Association of leisure activity participation and perceived levels of life satisfaction among elderly

Predictors	Participation frequency: *Rarely/Never versus:*	Perceived level of Life Satisfaction			
		Low vs. Medium		Low vs. High	
		RRR	95% CI	RRR	95% CI
Go to park/beach for relaxing	At least once a month	0.760	-0.495 – -0.051*	0.968	-0.216 - 0.152
	At least once a week	1.407	0.102 - 0.58*	1.546	0.225 - 0.646*
Play cards or indoor games	At least once a month	0.881	-0.357 - 0.104	0.656	-0.632 – -0.209*
	At least once a week	0.593	-0.814 – -0.228*	0.601	-0.751 – -0.266*
Play out door games/ /exercise/jog/ yoga	At least once a month	1.182	-0.002 - 0.337	0.947	-0.209 - 0.101
	At least once a week	0.993	-0.17 - 0.158	1.09	-0.052 - 0.225
Visit relatives /friends	At least once a month	1.185	0.094 - 0.245*	1.242	0.15 - 0.282*
	At least once a week	0.990	-0.116 - 0.097	1.002	-0.09 - 0.095
Attend cultural /shows/Cinema	At least once a month	1.004	-0.132 - 0.141	0.794	-0.353 – -0.106*
	At least once a week	0.849	-0.393 - 0.066	0.622	-0.68 – -0.265*
Attend religious functions /events	At least once a month	0.996	-0.098 - 0.092	1.052	-0.031 - 0.134
	At least once a week	1.044	-0.068 - 0.154	1.108	0.006 - 0.199*
Attend political/community/ meetings	At least once a month	0.991	-0.173 - 0.156	0.852	-0.307 – -0.012*
	At least once a week	0.795	-0.49 - 0.033	0.645	-0.669 – -0.207*
Read books/newspapers /magazines	At least once a month	0.904	-0.276 - 0.075	1.068	-0.084 - 0.217
	At least once a week	1.124	0.005 -	1.537	0.334 -

			0.229*		0.525*
Watch television/listen radio	At least once a month	1.132	-0.009 - 0.258	0.895	-0.233 - 0.013
	At least once a week	1.192	0.101 - 0.25*	1.256	0.163 - 0.293*
Use a computer for e-mail/net surfing etc.	At least once a month	1.295	-0.073 - 0.591	0.691	-0.694 - -0.044*
	At least once a week	0.909	-0.374 - 0.185	1.557	0.22 - 0.666*

Note: statistically significant at $p<0.05$

Certain social activities like visiting friends on a monthly basis (RRR: 1.242), or attending religious functions weekly (RRR: 1.108), are positively associated with high life satisfaction. Outdoor activities like sports or exercise, while showing a positive association with high life satisfaction (RRR: 1.090), do not reach statistical significance, suggesting a more nuanced impact on well-being. Conversely, some leisure activities, like attending cultural performances (RRR: 0.622), and attending political gatherings or community meetings on a weekly basis (RRR: 0.645) exhibit an inverse relationship with high life satisfaction are inversely associated with high life satisfaction. Similarly, social activities, though generally considered beneficial, show varied effects depending on the type of activity and its frequency. For instance, attending religious functions weekly is positively associated with high life satisfaction (RRR: 1.108).

Discussion and Conclusion

This study, grounded in the context of India's evolving demographic profile, specifically addresses the connection between leisure activity participation and life satisfaction among the elderly. Utilizing the comprehensive data from the Longitudinal Ageing Study in India (LASI) Wave-1, the research addresses a critical gap in the Indian literature by providing a nuanced understanding of how different forms of leisure activities impact the well-being of the elderly population - a demographic that is rapidly growing in number and significance. The study is uniquely placed at the intersection of gerontology and social welfare. Our methodological approach involved a rigorous analysis of a sample of 30,341 elderly individuals aged 60 and above, examining how their engagement in various leisure activities correlates with perceived life satisfaction.

Elderly life-satisfaction has been researched extensively in the West, in trying to understand the factors that associate with it. Among the said range of factors, leisure participation has emerged as a profound indicator for determining elderly well-being, and by extension, life satisfaction. (Nakahara, 2013, Blace, NP, 2012) However, evidences on this linkage are pretty limited in Indian literature. Due to the dearth of time-use or time-allocation data for elderly at the national level, research in Indian settings so far had been restricted to micro-studies only. Building upon the framework of Activity Theory, our study delineates the complex interplay between various forms of leisure engagement and perceived well-being in later life.

The initial findings, as outlined in Table 1, paint a demographic landscape of the elderly in India, predominantly residing in rural areas with a balanced gender distribution. This demographic overview sets the stage for a deeper understanding of life satisfaction nuances among different segments of the elderly population, as evidenced in Figures 1 and 2. These figures reveal that high life satisfaction is more prevalent in urban settings, particularly among male elderly, and tend to decrease with advancing age, especially in nonagenarians.

Table 3's findings further elucidate how demographic and socio-economic factors intersect with leisure activity participation. Notably, urban elderly individuals are more likely to engage in all categories of leisure activities, particularly outdoor and indoor activities, compared to their rural counterparts. This trend highlights the potential influence of urban settings in providing diverse leisure opportunities. Additionally, gendered patterns in leisure activity preferences emerge, with males being more active in all categories, especially outdoor activities.

Moving to the core of our study, the relationship between leisure activities and life satisfaction is examined through a detailed analysis. Table 2, for instance, shows that outdoor activities like visiting parks or beaches and engaging in sports or yoga weekly are significantly associated with high life satisfaction. This finding aligns with studies by Hughes and Gove (1981), emphasizing the importance of physical and recreational engagement for elderly well-being.

The domain of social activities presents a nuanced picture. While frequent visits to relatives or friends correlate positively with life satisfaction, our study intriguingly observes that infrequent participation in activities such as attending cultural performances aligns with an even greater proportion of high life satisfaction. This dichotomy suggests that the impact of social activities on life satisfaction may be more complex, varying with the nature and frequency of engagement. This complex relationship between social activities and life satisfaction may vary across different cultural contexts, as suggested by Victor et al. (2005).

Indoor and media-related pursuits, particularly reading and internet use, emerge as significant predictors of high life satisfaction. The strong positive association of these activities with high life satisfaction resonates with the findings of Kim et al. (2022), highlighting the role of cognitive stimulation in elderly well-being. This underscores the necessity to create opportunities for elderly digital literacy training and participation, as well as the development of elderly-friendly environments, such as parks and digital spaces, to enhance life satisfaction.

The multinomial logistic regression results detailed in Table 4 further elaborate on these relationships. The results suggest that weekly engagement in indoor activities, particularly educational or media-related, correlates significantly with high life satisfaction (RRR = 1.821, 95% CI: 1.723-1.924). This insight is pivotal in understanding the differential impact of various leisure activities on elderly life satisfaction, offering a lens through which to view the potential benefits of targeted leisure opportunities. A typically pronounced association of frequent reading, and internet use among elderly and high life satisfaction points to call for attention in creating opportunities for increased literacy, digital literacy, and access to leisure activities for the elderly should be a priority for policymakers and public-service providers.

In summary, the study contributes to the broader discourse on successful aging and the role of leisure activities. It highlights the varied bearings of the nature and frequency of leisure activities on elderly life satisfaction, underlining the importance of personalized and context-specific approaches to promoting well-being among the elderly in India. Notably, the study highlights the positive impact of frequent participation in indoor activities, especially those involving cognitive stimulation, on life satisfaction. This aligns with global research trends

and stresses the importance of mental engagement in elderly well-being. This research paves the way for more effective strategies in supporting a healthy and satisfying aging experience, leveraging both global insights and localized understanding of elderly needs and preferences.

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Assessing Opportunities for m-Health in Punjab: Mobile Phones Ownership and Internet Use among Women in Reproductive Age

Babita[1]

Abstract

With rapid technological transformation, digital platforms are leveraging health interventions in all parts of the country including remote and inaccessible areas. The recent COVID-19 pandemic saw a big spike in use of mobile phones for accessing health care needs when the health centres remained closed and the mobility was restricted due to lockdowns. Mobile devices are important instruments of accessing health care facility not only form public sector but also from private sources. Through mobiles it is easier to enhance health awareness, to connect the health care providers, book diagnostic test, know about a range of government programmes, identify nearby sources, benefit for telemedicine, etc. The programmes of government are also m-Health friendly. Few research has been done in recent times to understand the dimension of m-Health among some populations. However, little research has gone into understanding m-Health its determinants, potential and implication among women in the reproductive age group (15-49 years) in the state of Punjab. The present paper is based on National Family Health Survey (NFHS) as available in its 5th round (2019-21).

Keywords: Women, Gender, Education

Introduction

India completed 25 years of mobile telephony in 2021. The mobile revolution which started in 1995 in the country, brought a lot of changes in the domain of communication besides changes in lifestyles. Gradual improvement in the mobile sets, introduction of smart phones with ever increasing features and availability of mobile applications have revolutionised human living in every way. A service which was, in the beginning, meant for the elite and upper classes, has now reached almost everyone including those in the bottom of the pyramid. Indian Cellular and Electronics Association (ICEA) estimates that by December 2022 India's total smartphones users was around 83 crores, and 40 percent of these users were from the rural areas. Mobile telephony has become the lifeline in modern India affecting livelihood, entertainment, healthcare, education, trade and commerce and others.

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Recent years have seen an exponential growth in application of mobile phones in health sector. Common citizen, patients, para-medical staff and physician all depend on mobile phone for enhancing health awareness, diagnose illness, schedule meetings learning about equipment and medicines, buying of medical products, monitoring health, handling emergency situations etc.

Because of increased demand for a range of functions to make life comfortable and convenient, mobile phones and digital technologies have become one of the effective healthcare delivery tools.

Mobile services are of special relevance to women who constitute about half of the total population of India. It is considered an unique tool for gender empowerment and human development. The Sustainable Development Goals (SDGs) for 2030 which commit India to gender equality, technical innovations, power of information and knowledge, social inclusion, economic prosperity and freedom of expression are not easily attainable without women having access to mobile phones. Mobile phones become a force multiplier with access to internet. Internet opens a vista of opportunities for women to improve their health.

Realizing the importance of digitalisation in healthcare, the Government of India launched the Digital India Programme that aims to advance the digital infrastructure and make it accessible to every citizen in the year 2015. The intended impact of this programme goes beyond building technological infrastructure to connecting and empowering people in the areas such as health and education. From the health systems perspective, this programme created a helpful environment for increasing access to health-related knowledge, services and transparency in delivery of care. A report by (Scoping Health 2016) as a part of Digital India programme, the Government of India launched four m-Health initiatives: *Kilkari*, Mobile Academy, mCessation and TB Missed Call initiatives on 15th January 2016. The intent of the programme was to enhance access, make healthcare services cost effective and to make the system more robust. The initial two initiatives related to reproductive and child health and brings women to the forefront of m-Health by addressing their health concerns.

Mobile Health, or m-Health, describes the use of mobile and wireless communication technologies to improve healthcare delivery, outcomes, and research (Singh and Landman 2017). It provides effective access to people, including rural populations located in remote

locations and takes self-care in health to a higher level and includes the use of telecommunication and multimedia technologies integrated with mobile and wireless healthcare delivery system. WHO's Global Observatory for e-Health defined m-Health as "*medical and public health practices supported by mobile devices such as mobile phones, patient monitoring devices, personal digital assistance and other wireless devices*". Different mobile applications designed for lifestyle monitoring, patient follow-ups, health education are incorporated into m-Health. The Government of India initiated several information communication technologies (ICT) to augment m-Health intervention in remote locations and telemedicine is an example of m-Health in the grassroots to empower the health service providers.

Mobile and internet penetration have risen significantly in India and particularly among women. The fact that mobile phones play an important role in lives of women in a patriarchal society is in disputable. Since cultural norms restrict their physical mobility and in-person conversations outside the household, women find mobiles with internet connection useful to break the barriers of isolation and move ahead in the cultural of silence.

Mobile phone use is positively associated with women's decision making power and financial autonomy, but they also show that women's access to mobile phones is often restricted. Access restrictions for women to use mobile phones are not only due to income constraints, but also to strict gender and social norms in many societies.

Gendered differences in mobile phone use are more significant in India than in most other parts of the world. Women are still less likely to be aware of mobile, internet than men, and while awareness has been increasing, growth has slowed, even in countries where awareness remains relatively low. Social media can mobilize women's empowerment through technology by increasing their representation in the public sphere. The more use of social media by women provides significance opportunities to highlight the issues of gender equality and women's right. A report by India Inequality (2022) Digital Divide released by the NGO, Indian women are 15 percent less likely to own a mobile phone and 33 per cent less likely to use mobile internet services than men.

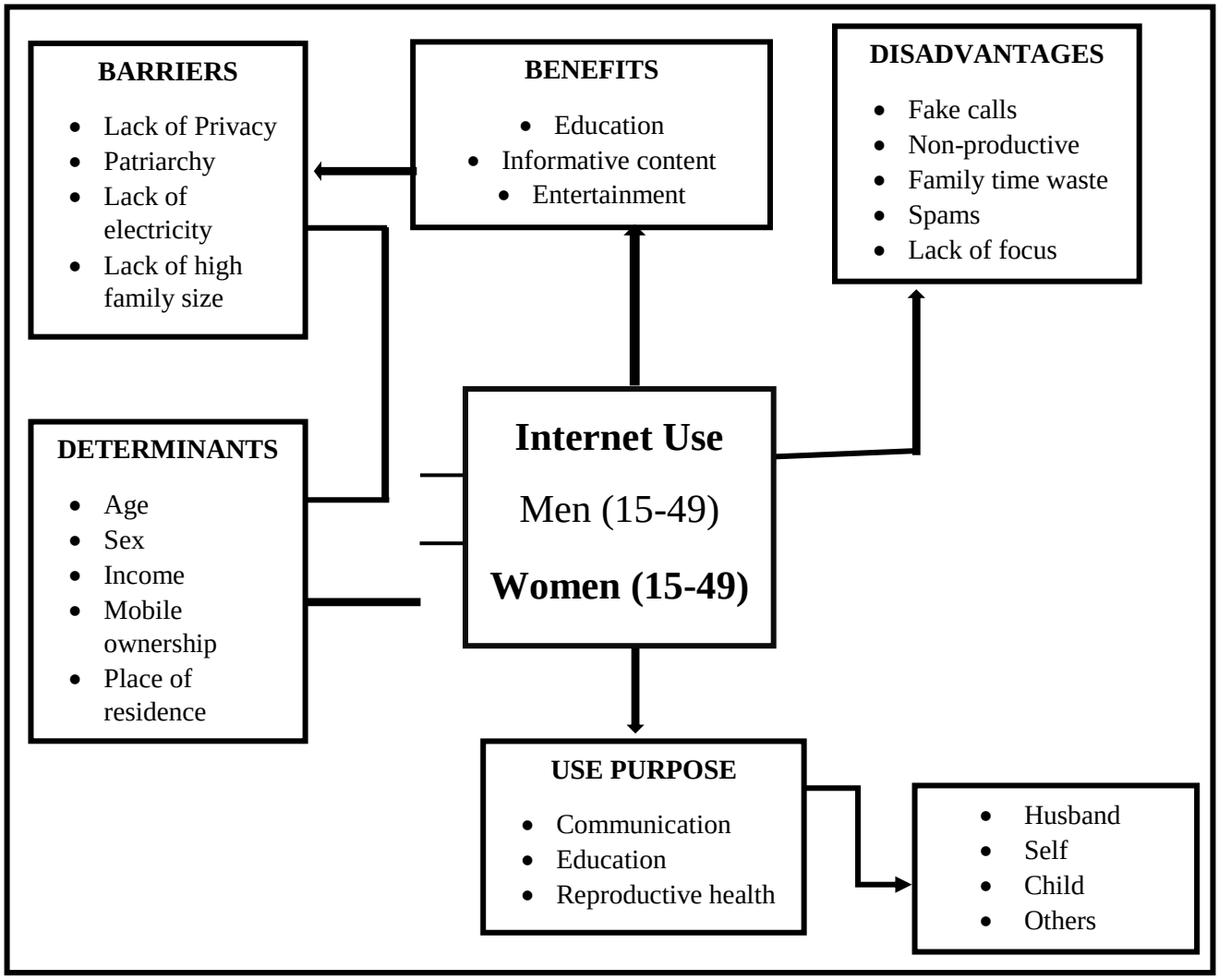
Objectives

m-health, in all its manifestations, is systematically connected to the mobile phone ownership. Unless the individuals own such phone, and operate them for their own welfare, it is difficult to imagine the beneficial impacts of mobile phones. Though women are more health conscious for self and their own families than men, and are more prolific in using their phones for better health outcomes, yet mobile ownership among them is substantially lower than their male-folks. Such as skewed ownership of mobile phones, which is considered to be the gateway to the outer world, is structurally determined in Indian society and has adverse consequences for overall health. Hence, it would be of interest to examine mobile ownership among women that is considered to be a precursor to benefits of m-health.

In the light of above, the present paper is devoted to assessment of the progress in spread of mobile telephony in India from a gendered perspective. The paper primarily aims to examine how mobile telephony ownership and use varies among adult women in the state of Punjab. However, the specific objectives of the paper are:

- To investigate the mobile telephone ownership among adult women (15-49 years), and
- To relate the pattern of ownership of mobile to the selected socio-economic background characteristics of women (15-49 years).

Figure 1.1:Conceptual Framework of m-health



Data and Methods

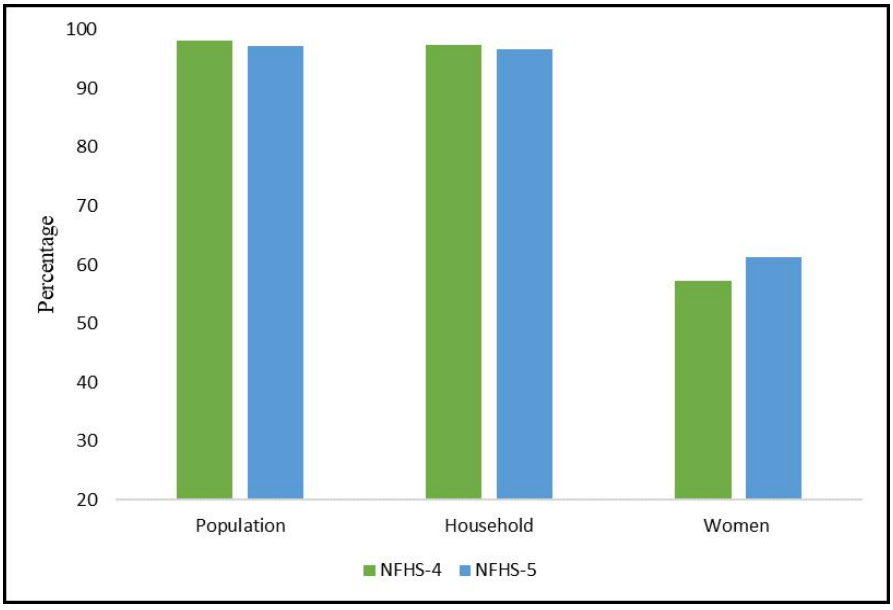
The paper is primarily based on secondary data source that are widely recognized as leading in the field of health and population. The source is National Family Health Survey (NFHS). National Health Survey is a leading source of demographic and health statistics since 1992-93 and offers comprehensive information up to districts level. Data for used from this source to reflect on the situation in Punjab and its districts. The paper will use data from the National Family Health Survey (NFHS-5), 2019-21 to examine interlinkages between cell phone ownership, internet use and selected socio-economic characteristics of women (15-49 years) to arrive at the stated objectives. Besides the state as a whole inter-district variations and

selected socio-economic characteristics of women (15-49 years) are also examined. In National Family Health Survey, 2015-16 adult women (15-49 years) having a mobile phone they themselves use in rural 47.9 percent and urban 71.9 percent and in National Family Health Survey, 2019-21 in rural 54.9 percent and urban 71 percent. In NFHS-5 in rural areas adult women (15-49 years) having a mobile phone they themselves use is increasing by 7 percent. As usual use of secondary data sources for analysis has a few limitations in terms of data quality, content and coverage.

Study Area

Punjab, a progressive state in the north-west, is known for its achievements in the field of health, education and empowerment of women. The fact that state improved its ranking in Human Development Index (HDI) from 6th in 1990 to 3th in 2017 among all the states in Indian union, is a pointer to states rapid progress in social economic in health sector. The official and regional language of Punjab is Punjabi. The literacy rate of Punjab is almost 75 percent. As per Census 2011, the State of Punjab, has the highest percentage of Scheduled Caste (SC) population amongst all the states of the Country. Near about 31.94 percent of the total population in the state belonged to weaker section such as SCs in 2021.

Figure 1.2: Ownership of mobile phone among population, household and women (15-49 years), Punjab 2015-16 and 2019-21



Source: National Family Health Survey, (NFHS-4) (NFHS-5), IIPS, Mumbai 2015-16 and 2019-21

Figure 1.2 displays a certain pattern of mobile phone ownership among the population, households, and women (15–49 years). The National Family Health Survey (NFHS-4) for 2015–16 and (NFHS–5) for 2019–21 is also used to compile data. Men own more mobile phones than women in a nation where household ownership and population are roughly equal. Mobile phone access was restricted for women in the reproductive age range of (15–49 years) old. Mobile phone usage is comparatively high despite a lower percentage of ownership.

Figure1.3: Punjab and Its Districts

Results and Discussion

The inter-district variations of ownership of mobile phone and internet use among the adult women in Punjab (15-49 years), in the state of Punjab.

Table 1.1: Inter-district variations (percentage) have mobile phone use and internet use of women (15-49 years), in districts of Punjab 2019-21

S. No.	Region/ Districts	Mobile phone use	Internet use	Number of women (15-49)
		Yes	Yes	(N)
***Majha*region**				
1	Amritsar	96.5	79.3	1101
2	Gurdaspur	94.6	78.3	761
3	Pathankot	94.6	79.0	304
4	Tarn Taran	92.2	67.3	500
***Doaba* region**				
1	Hoshiarpur	96.4	80.9	818
2	Jalandhar	97.6	85.8	1043
3	Kapurthala	96.8	74.8	389
4	SBS Nagar	97.0	83.9	293
***Malwa* region**				
1	Barnala	97.2	75.0	267
2	Bathinda	96.7	64.1	701
3	Fatehgarh Sahib	96.5	89.5	273
4	Faridkot	95.6	63.2	288
5	Fazilka	97.0	62.9	532
6	Firozpur	98.0	70.4	324
7	Ludhiana	97.6	81.2	1505
8	Mansa	95.9	63.1	349
9	Moga	97.7	76.4	465
10	MuktsarSahib	96.5	66.4	413
11	Patiala	96.7	82.7	940
12	Rupnagar	96.7	85.4	315
13	SAS Nagar	97.5	87.7	492
14	Sangrur	98.1	75.9	744
PUNJAB		**096.7**	**77.1**	**12817**

Source: National Family Health Survey (NFHS-5), IIPS, Mumbai 2019-21

Table 1.1 demonstrates that more women in the Amritsar area use the internet and mobile phones more frequently. The percentage of mobile phone users in the districts of Gurdaspur and Pathankot is the same. However, the Tarn Taran area in the *Majha* region has a lower internet usage rate. Women use mobile phones and the internet more frequently in the

Jalandhar district of the *Doaba* region, and their proportion is higher overall. The *Malwa* region's Bathinda, Patiala, and Rupnagar districts have the same percentage of mobile phone users. However, in the Sangrur district, women use cell phones more frequently. But Fatehgarh Sahib has a higher internet usage rate. In contrast, there is a higher proportion of mobile phone users in Punjab. But fewer people own mobile devices.

Table 1.2: Prevalence (percentage) of mobile phone use and internet use among women (15-49 years), by selected socio-economic background characteristics, Punjab 2019-21

S. No.	Socio economic indicators	Mobile phone use	Internet use	Number of women (15-49)
		Yes	Yes	(N)
1	**Sex of the head of the household**			
	Female	95.7	75.0	2048
2	**Religion**			
	Hindu	95.6	75.6	4911
	Muslim	82.4	41.2	130
	Sikh	95.7	75.1	7545
3	**Social group**			
	SC	94.7	65.8	5767
	ST	100.0	57.1	85
	OBC	96.0	79.9	1799
	General	96.6	16.2	5167
4	**Place of residence**			
	Urban	96.9	79.3	5034
	Rural	94.8	72.3	7783
5	**Wealth index**			
	Poorest	45.7	8.6	178
	Poorer	84.1	24.5	684
	Middle	91.1	41.6	1484
	Richer	97.2	66.7	2760
	Richest	98.2	89.9	7713
6	**Bank account**			
	Yes	87.1	75.8	12262
	No	96.0	60.2	554
7	**BPL card**			
	Yes	95.3	70.1	2490
	No	95.7	76.3	10328
8	**Land useable for agriculture**			
	Yes	95.3	84.6	2972
	No	96.7	72.8	9844
	PUNJAB	**61.2**	**54.8**	**12817**

Source: National Family Health Survey (NFHS-5), IIPS, Mumbai 2019-21

Table 1.2 focuses on how socio-economic status, Internet, and mobile phone use among women (15-49 years) are directly associated. However, women are less likely to utilize the Internet than men. Additionally, Sikh women use more mobile phones than Hindu women, and Sikh women are more numerous overall. Women from Scheduled Tribes (ST) are highly under represented.

Compared to women in rural regions, urban women are more interested in utilizing their phones and the Internet. According to the wealth index, the wealthiest women use the Internet and mobile phones more frequently than the poorest women, who use them less frequently.

The model used internet use among women as a dependent variable The independent variables taken were categorical such as religion, caste, place of residence, house type, mobile phone ownership, computer ownership and wealth status in terms of household durable assets. In order to identify variables associated with the type of fuel used binary logistic regression model was used.

Table 1.3: Logistic regression of internet use among women (15-49), in Punjab

Background characteristics of women	B	Sig.	Exp (B)	95% C.I. for EXP(B)	
				Lower	Upper
Caste					
SC®	-	-	-	-	-
ST	-.272	.343	.762	.434	1.338
OBC	.259	.001*	1.295	1.112	1.510
General	.261	.000*	1.298	1.153	1.460
House type					
Kuccha®	-	-	-	-	-
Semi	-.397	.053	.672	.450	1.006
Pucca	-.576	.006	.562	.374	.845
Religion					
Hindu®	-	-	-	-	-
Muslim	.481	.052	1.617	.995	2.626
Sikh	-.140	.014	.869	.777	.972
Other	.102	.577	1.107	.774	1.585
Place of residence					
Rural	.260	.000*	1.296	1.153	1.457
Wealth index					
Poorest®	-	-	-	-	-
Poorer	.817	.001	2.265	1.413	3.629

Middle	1.554	.000	4.731	2.992	7.483
Richer	2.473	.000	11.858	7.481	18.796
Richest	3.858	.000	47.371	29.642	75.704
Mobile phone					
Yes	1.537	.000	4.653	3.543	6.110
Computer					
Yes	1.577	.000	4.841	3.687	6.356
Constant	-2.860	.000	.057	-	-

The odds ratio shows that as the category moves from SC to OBC and general the use of internet increases by 30 percent. Similarly, the use of internet is 30 percent increases in the rural area with a unit change as the change in the wealth category takes place from the poorest to the middle, richer and richest category the use of internet increases by many folds. Similarly, the use of internet is 30 percent increases in the rural area with a unit change. Moreover, the people who own mobile phones and computers the use of internet is four times higher among them.

Table 1.4: Selected determinants of access to internet use among women (15-49 years), Punjab

S. No.	Districts	MDPI index[$]	Share of women with 10 or more years of schooling[#]
1	Mansa	9.99	37.5
2	Firozpur	9.42	47.5
3	Fazilka	9.42	41.3
4	Tarn Taran	8.31	40.4
5	Moga	8.01	45.2
6	Muktsar	7.71	39.8
7	Amritsar	7.42	56.7
8	SBS Nagar	7.24	65.4
9	Barnala	5.8	53.1
10	Bathinda	5.6	41.1
11	Kapurthala	5.2	60.3
12	Gurdaspur	5.11	64.6
13	Pathankot	5.11	74.0
14	SAS Nagar	5.1	62.5
15	Hoshiarpur	4.49	73.2
16	Ludhiana	3.83	61.6
17	Patiala	3.75	56.0

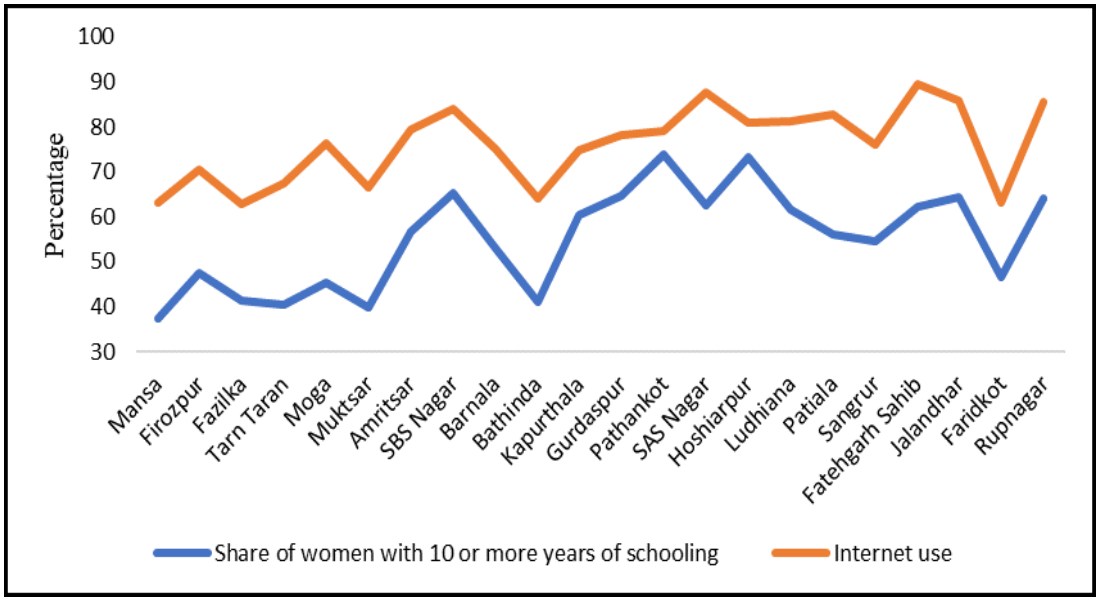
18	Sangrur	3.56	54.4
19	Fatehgarh Sahib	3.49	62.3
20	Jalandhar	3.31	64.4
21	Faridkot	2.96	46.5
22	Rupnagar	2.01	64.0
PUNJAB		**5.59**	**56.0**

Source: `$`-National Multidimensional Poverty Index, Niti Ayog, New Delhi, 2021, #- National Family Health Survey(NFHS-5), IIPS, Mumbai 2019-21

The districts that record high multidimensional poverty index (MDPI) (namely Mansa, Firozpur, Fazilka, Tarn Taran, Moga, Muktsar, Amritsar, SBS Nagar, Barnala, Bathinda, Kapurthala). In contrast, the districts that are relatively more developed (namely Gurdaspur, Pathankot, SAS Nagar, Hoshiarpur, Ludhiana, Patiala, Sangrur, Fatehgarh Sahib, Jalandhar, Faridkot, Rupnagar).

With poverty and economic prosperity being the two main factors influencing mobile phone ownership and internet access among women (15-49 years), education is also a significant factor. Table 1.4 highlights the Punjab districts with the highest levels of poverty and lowest levels of education.

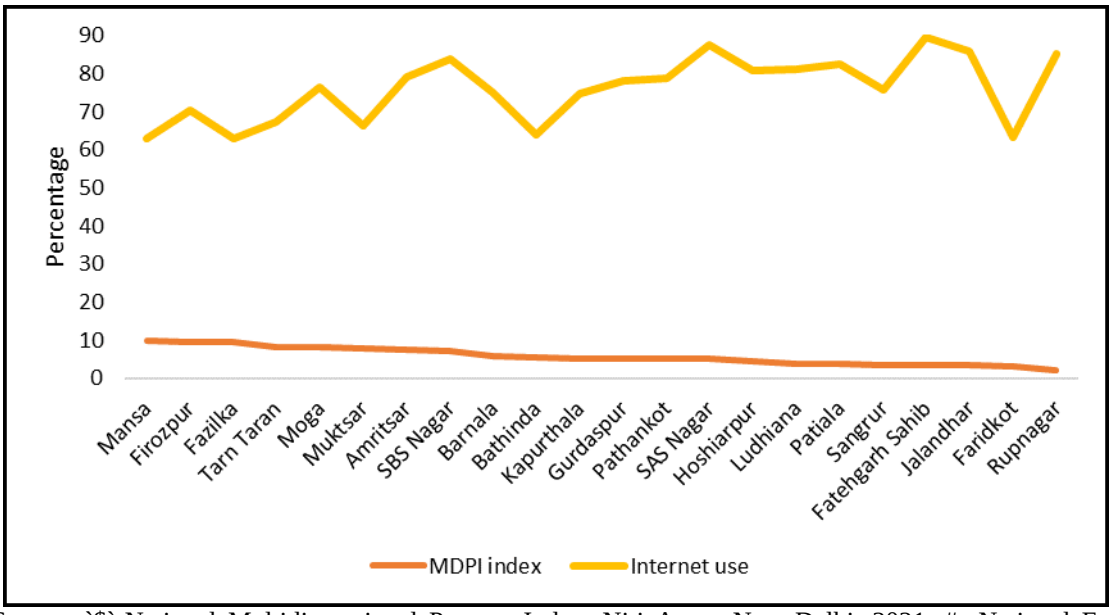
Figure 1.4: Selected determinants of access to internet use among women (15-49 years), with 10 or more years of schooling, Punjab



Source: National Family Health Survey (NFHS-5), IIPS, Mumbai 2019-21

Figure 1.4 shows that in Punjab districts with higher levels of education, internet use is also higher, whereas in some districts with lower levels of education, internet use is lower.

Figure 1.5: Selected determinants of access to internet use among women (15-49 years), with multidimensional poverty index



Source: `$`-National Multidimensional Poverty Index, Niti Ayog, New Delhi, 2021, #- National Family Health Survey (NFHS-5),
IIPS, Mumbai 2019-21

Figure 1.5 shows the multi-dimensional poverty index for Internet use. Internet access is low in some districts with high poverty rate sin Punjab. Because in some places there is a lack of education, women are not getting access to the internet.

Conclusions

Mobile phone ownership is very low among women (15-49 years), but access to mobile phones and the Internet is greater. Mobile phones seem to contribute to female autonomy and empowerment in India. Women's mobile phones and internet use are positively associated with their physical mobility. Also, mobile phones and internet use can help connect women to information and build social networks. The suggestions relate that men have more ownership of mobile phones than women of reproductive age group and women use mobile phones on a sharing basis. And also, ownership of mobile phone is less but use of mobile phone is higher.

To increase the ownership of mobile phones, use of mobile phones, and the internet, women need to be made more educated and aware. Mobile use and internet use is a medium of interaction and provides immense opportunities and benefits in social, political, and economic domains. Mobile use and internet use is more beneficial for women because they will increase women's horizon and thus, would address the disparity between men and women will also be reduced.

Directions for Future Research

The present research provides significant leads for further research on this subject. For instance, a need to look at "Why mobile ownership has not reached a higher level among women in spite of the financial prosperity of the households?". Similarly, one needs to understand if a rise in mobile telephone ownership among women automatically leads to an increase in internet use among women. Given the dynamic linkages between mobile telephone use and the social empowerment of women in Punjabi society, it is useful to assess on what content the mobile internet is used for. Greater use of the internet through mobiles for information related to health, nutrition, education personal safety, weather conditions or even entertainment is highly functional. Content analysis research would help to understand how and if the internet is used for human capital development and the growth of individual personalities. Further research on these areas the horizons of knowledge, policy and programme.

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