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Publications from Institute

1. **Nutan Kumari., Paul, S., Noolvi, C. N., & Shruthi, S. (2025).** Exploring disparities in modern spacing contraceptive use among tribal and non-tribal women in India: Evidence from NFHS-5. *International Journal of Health Sciences and Research, 15(4),* ISSN 2249-9571.

2. **Nutan Kumari., & Yadav, R. (2025).** Menstrual hygiene practices and its predictors among tribal adolescents in India: Insights from National Family Health Survey-5. *International Journal of Research and Analytical Reviews, 12(2),* 1–10. ISSN 2349-5138.

3. **Nutan Kumari., & Ram, R. (2025).** Socio-economic and demographic determinants of polygynous marriages in India: Multilevel analysis of nationally representative survey, 2019–21. *Sexuality & Culture, 29*(3), ISSN 1174–1192.

4. **Golandaj, J. A., & Asagi, R. (2025).** Health risks of open dumping sites: Findings from a pilot case-comparative study in Dharwad, India. *IER Journal of Health and Demography, 10*(2), 27–39. ISSN 2454-9207.

5. A session on "Tuberculosis Elimination" was organized under JSS IER DVH Chair for JSS Degree College students, in collaboration with the District National Tuberculosis Elimination Programme (NTEP), Dharwad, Karnataka, to support of the Pradhan Mantri TB Mukt Bharat Intensive Campaign.

6. Population Research Centre, JJS Institute of Economic Research, Dharwad, in collaboration with JSS KHK College, jointly organized a Yoga Sangam event to commemorate the International Day of Yoga on 21st June 2025.

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Editorial Board

Padma Vibhushan, Dr. D. Veerendra Heggade Chair for Studies on Health and Demography, JSS Institute of Economic Research (IER), Dharwad.

Institute of Economic Research (IER) is one of the institutions of Janata Shikshana Samiti (JSS) was established in 1957. Population Research Centre, fully funded by the Ministry of Health and Family Welfare (MoHFW), Government of India was attached to IER during 1961. The primary aim of the centre is to undertake the research activities on Health and Demography.

Sri. Vishwaprasanna Theertha Swamiji, Pejavar Matt, Udupi is the President of JSS. The visionary Padma Vibhushana Dr. D. Veerendra Heggade, Dharmadhikari of Shri Kshetra Dharmasthala is the Chairman. The activities of the Samiti are being led by Dr. Ajith Prasad, Secretary.

Padma Vibushana Dr. D. Veerendra Heggade, is a well known visionary of our times. Ever since he assumed the responsibility as a Head of Shri Manjunatha Swamy Temple Dharmasthala, (South India's renowned religious landmark located in Karnataka) he is successfully implementing multi disciplinary programs for social and economic well being of the society. He is the President of SDM Education Society and SDM Medical Trust that runs several institutions. His Self-employment training Institute made millions of youths as self-reliant. By various rural development programmes, he has organized thousands of Self-Help Groups in Karnataka and Kerala to empower rural women, to create health awareness and to enable health insurance for millions of poor. Dr. Heggade is the recipient of several National and International awards for his contributions in the field of education, health and rural development.

To support his novel health programmes, Dr. N Vajrakumar former Secretary of JSS intended to install an Endowment Chair in the name of Dr. D. Veerendra Heggade for facilitating the programmes on Health and Demography in the JSS IER, Vidyagiri, Dharwad. This plan was announced during 75th Birthday of Dr. N. Vajrakumar.

Vision of the Chair:

To facilitate research work on Health and Demography

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<u>ARTICLES</u>

PTSD and Health Related Quality of Life Among COVID-19 Survivors in Relation to Their Personality

Sridevi P[1] and Vijayalaxmi A. Aminabhavi[2]

Abstract

The COVID-19 pandemic had a major effect on lives. Post-Traumatic Stress Disorder (PTSD) and health related quality of life are considered as the important outcome measures for COVID-19 Survivors. This study intends to know how COVID-19 survivors with three personality types (Sattva, Rajas, Tamas) differ among themselves in their PTSD and health related quality of life. The data was collected from the sample of 115 COVID-19 survivors through an online survey. The obtained data was scored and further subjected to one way analysis of variance. The results revealed that personality types differ significantly in changes in cognition and mood dimensions of PTSD, and in pain area of health-related quality of life. Further post hoc analysis revealed that COVID-19 survivors with tamas personality showed significantly higher pain and changes in cognition and mood than COVID-19 survivors with sattva and rajas personality. The findings endorse that COVID-19 survivors with tamas personality are more vulnerable for high stress disorders and low quality of life.

Keywords: PTSD, Health Related Quality of Life, COVID-19 Survivors, Personality

Introduction

Fear, worry, and stress are normal responses to perceived or real threats, and at times when we are faced with uncertainty or the unknown. So, it is normal and understandable that people are experiencing fear in the context of the COVID-19 pandemic.

Added to the fear of contracting the virus in a pandemic such as COVID-19 are the significant changes to our daily lives as our movements are restricted in support of efforts to contain and slow down the spread of the virus. Faced with new realities of working from

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home, temporary unemployment, home-schooling of children, and lack of physical contact with other family members, friends and colleagues, it is important that mental, as well as physical health is considered.

In contrast, few reports are available on mental health sequelae among COVID-19 survivors. Two reports from China (Yao et al., 2020a; Zhu et al., 2020) and a recent correspondence in the Lancet (Yao et al., 2020b) draws attention to the increased vulnerability for infection among those with pre-existing mental illness. Reasons pointed out include cognitive impairment, poor adherence to hygienic practices and social discrimination against mentally ill people which may prevent them from accessing services in a timely manner.

Post-traumatic stress disorder symptoms may start within one month of a traumatic event, but sometimes symptoms may not appear until years after the event. These symptoms cause significant problems in social or work situations and in relationships. They can also interfere with your ability to go about your normal daily tasks.

Delayed Onset of Post-Traumatic Stress Disorder (PTSD) is little-known subtype of PTSD is the subject of recent research. Scientists have found that nearly one in four PTSD diagnoses may be delayed onset. The technical definition of this condition is that a person does not develop a diagnosable post-traumatic stress disorder until at least six months after exposure to a traumatic event. Sometimes, it may take years for a person to begin displaying a trauma response. This type of PTSD is mostly observed among older people, who may have experienced a deep trauma when they were younger. However, those in recovery may also be at risk.

Health related quality of life (HRQoL) is a comprehensive multi-dimensional measure of a person's subjective physical and mental health including self-perceptions regarding symptoms of diseases or health conditions, functional status across various life aspects, life quality and satisfaction. HRQoL is concerned with assessing how health affects an individual's ability to function and their perceived well-being in physical, mental and social domains of life. The functioning in HRQoL refers to basic activities like self-care (for example bathing, dressing etc), work related activities like housework, career. It also

encompasses the extent to which an individual is able to interact with family and friends (social functioning).

The concept of health-related quality of life and its causal factors have changed since the 1980's to include domains of overall quality of life that has an impact on health either physical or mental (Gandek et al 2004, McHorney 1999, Selim et al 2009).

On a personal level, HRQoL includes subjective understanding about the person's physical and mental health (mood, energy level etc.) and their correlates- health risks, functionality, social support, socioeconomic conditions. On a community level, HRQoL involves community level resources, policies and practices that have an effect on the health perceptions and functional status of the population of that community.

A growing body of research highlights the psychological consequences of COVID-19, particularly the prevalence of PTSD and reduced HRQoL among survivors in relation to their personality.

A systematic review and meta-analysis by Nagarajan et al. (2022) assessed the prevalence of PTSD in survivors of severe COVID-19. Analyzing data from 13 observational studies (N = 1,093), they found a pooled PTSD prevalence of 16% (95% CI: 9%–23%), with high heterogeneity (I^2 = 87.9%). Regional differences in prevalence were statistically significant, and publication bias was observed. The authors emphasized that severe COVID-19 illness increases the risk of PTSD, although methodological limitations in included studies must be considered.

Similarly, Kaseda and Levine (2020) examined how PTSD symptoms could emerge in COVID-19 survivors due to both direct neurological effects of the virus and indirect effects such as ICU admission and mechanical ventilation. Drawing from past outbreaks like SARS and MERS, they warned of difficulties in distinguishing PTSD-related cognitive complaints from those caused by acquired brain injuries. The study offered recommendations for assessing PTSD in post-COVID populations, especially within neuropsychological practice.

From a qualitative perspective, Wu et al. (2021) explored the lived experiences of hospitalized COVID-19 survivors in Nanning, China. Their analysis identified eight key

domains affecting HRQoL, including physical symptoms, anxiety, trauma, economic hardship, stigma, and lifestyle changes. The study emphasized the need for integrated health and social services to support survivors' rehabilitation.

A broader systematic review by Dorri et al. (2021) synthesized findings from 21 studies assessing psychological distress and HRQoL in COVID-19 survivors. Results indicated significantly reduced scores in domains such as social functioning, role physical, and role emotional health. Mental health issues were more pronounced in women and in those who had experienced severe illness. Though PTSD was less prevalent than anxiety or depression, it remained a notable concern.

In the Indian context, Sravanthi et al. (2022) investigated personality traits and aggression in COVID-19 survivors. Among 157 patients in Telangana, 18.5% showed signs of aggression. Individuals with higher neuroticism and lower agreeableness were more likely to report aggressive intent. The study highlighted the need for psychological screening and early intervention to prevent long-term adjustment difficulties.

Expanding on personality's role in coping, Prentice et al. (2020) examined how emotional intelligence (EI) and personality traits influenced responses to pandemic-related stressors. They found that while EI predicted all coping strategiestask-oriented, emotion-focused, and avoidancepersonality traits played a more limited role. When both variables were considered together, EI showed a stronger predictive value, suggesting its centrality in resilience-building.

Objectives

- To assess the personality of COVID-19 survivors and group them into Sattva, Rajas, and Tamas.
- To assess PTSD and health related quality of life of COVID-19 survivors.
- To know if COVID-19 Survivors with varying personality types differ significantly among themselves in their PTSD and health related quality of life.

Research Question: Do COVID-19 survivors with different personality types differ significantly among themselves in their PTSD and health related quality of life ?

Hypotheses

The above raised question led to the formulation of some hypotheses as shown below:

H1: PTSD outcomes, including re-experiencing, avoidance, alterations in cognition and mood, arousal/reactivity, distress/interference, and overall PTSD severity, differ significantly across COVID-19 survivors with different personality types.

H2: Health-related quality of life, including physical functioning, role limitations due to physical or emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health, differs significantly across COVID-19 survivors with different personality types.

Methodology

Variables

Independent variables: COVID-19 Survivors with sattva, rajas and tamas personality types.

Dependent Variables: PTSD and Health related quality of life

Sample

Purposive sampling method was used where the sample units are selected because they have the characteristics that is needed, i.e., being a COVID-19 survivor. The responses were collected from 115 COVID-19 survivors from Bengaluru.

Sample Inclusion criteria

- Individuals are infected and identified with COVID-19 pandemic by doctors as positive.
- Individuals age between 20 to 60 years.

Sample Exclusion criteria

- Individuals declared themselves as positive without medical testing.
- COVID-19 survivors who had average scores in sattva, rajas and tamas personality types.
- Individuals who are below 20 years and above 60 years.
- Individuals who cannot read and write English.

Operational Definitions

- **COVID-19 Survivors**: One who remains alive and continues to function during and after overcoming a serious hardship or life-threatening disease, (COVID 19)

- **Personality**: All human beings are combinations of the three *gunas* and therefore these three features together promote different kinds of personalities based on the dominance of one or the other *Gunas*.

- **PTSD**: it is a psychiatric disorder that may occur in people who have experienced or witnessed a traumatic event such as a natural disaster, a serious accident, a terrorist act, war/combat, or rape or who have been threatened with death, sexual violence or serious injury.

- **Health related quality of life**: A multidimensional concept encompassing areas of physical, mental, emotional and social functioning. It is an individual's perceived idea of their physical and mental health over time.

Measures

Vedic Personality Inventory (Dr. David Wolf, 1998)

The Vedic Personality Inventory (VPI) is the most extensively researched and validated psychological assessment tool based on the three gunas. Understanding the guna profile can be a powerful tool towards self-realization and can provide insight to what types of vocation will be most satisfying for you. Also, the results from the VPI can serve as a foundation for systematic, scientific elevation of the spiritual consciousness. Vedic Personality Inventory was used for the study. The VPI inventory is based on the concept of the guna personality from the Bhagvadgita, a traditional text of yoga, which was developed by David B. Wolf. This measure of the three gunas contain 56 questions and have 7 response choices. There are 15 items for sattva, 19 for rajas and 22 for tamas.

Post-traumatic symptom scale Interview Version for DSM V (Foa et al, 2013)

The PSS-I-5 is a 24-item semi-structured interview that assesses PTSD symptoms in the past month and makes a diagnostic determination based upon *DSM-5* criteria. The PSS-I-5 begins with a Criterion A trauma screen and identification of an index trauma if multiple events are reported. Questions assess for frequency and intensity of 20 *DSM-5* PTSD symptoms. An additional four items ask about distress and interference caused by PTSD symptoms as well

as onset and duration of symptoms. Symptom items are rated on a 5-point scale of frequency and severity ranging from 0 (Not at all) to 4 (6 or more times a week / severe). Symptoms are considered present when rated 1 or higher. **Reliability:** The PSSI-5 demonstrated good internal consistency ($\alpha = .89$) and test-retest reliability ($r = .87$), as well as excellent interrater reliability for the total severity score (intraclass correlation = .98) and interrater agreement for PTSD diagnosis ($\kappa = .84$). Inter-rater reliability for PTSD diagnosis ($k = .84$) and overall severity ($r = .98$) are excellent (Foa et al., 2016). (Foa et al., 2016). **Validity:** According to Foa et al., (2016), the PSS-I-5 demonstrated convergent validity with 3 gold standard measures of PTSD, (the CAPS, the PDS-5, and the PCL-IV-Specific Version; all r > .72), and discriminant validity with the Beck Depression Inventory-II, and State-Trait Anxiety Inventory-Trait Scale.

Rand 36 Items Health Survey (Hays et al, 1995)

The Short Form 36 Health Survey (SF-36) is one of the most widely used generic HRQL questionnaires. It was developed in the USA for use in the RAND corporation's health insurance experiment and has subsequently been used around the world to gauge the health of populations and to help with service planning. A validated Italian version is available. The SF-36 contains eight scales, assessing the quality of life across different domains with physical and mental components. It includes 8 health concepts- physical functioning, bodily pain, role limitations due to physical health problems, role limitations due to emotional or personal problems, social functioning, emotional well-being, energy/fatigue, and general health perceptions. **Reliability:** Cronbach alpha for each subscale was found to be 0.78 or above**. Validity:** The criterion validity was assessed by comparing scores for seven multi-item dimensions assessing functional status and well-being with a single global health question. Statistically significant trends were observed for decreasing SF-36 scores with worsening self-rated general health. (Jenkinson, Wright and Coulter, 1994)

Design

Exploratory and empirical research design will be adopted to investigate and verify stated hypotheses.

Ethical Considerations

- Consent was obtained from the participants.

- Participants were explained about the right to withdraw from the study at any time

- Participants were explained about how their responses will be used.

- Anonymity of the participants identity and confidentiality of the data gathered was ensured.

Analysis

One way analysis of variance will be used to examine whether there are any statistically significant differences among COVID-19 survivors with different personality types on their PTSD and health related quality of life. Hereby, determining the impact of personality on PTSD and health related quality of life.

Results

The one-way analysis of variance test was conducted using SPSS software to test the hypotheses stated above. The one-way ANOVA test findings suggest that COVID-19 survivors with different personality types (sattva, rajas and tamas) significantly differ in cognition and mood aspect of PTSD, and pain areas of health-related quality of life. Accordingly, the hypotheses related to cognition and mood (p=.047) as well as pain (p=.012) are accepted.

Table 1: Means, standard deviations, and one way analysis of variance in PTSD and health related quality of life

Measure	Sattva		Rajas		Tamas		F	p
	M	SD	M	SD	M	SD		
Re Experiencing	9.74	2.34	9.35	2.46	9.38	2.24	0.33	.718
Avoidance	3.76	1.24	3.88	1.29	4.11	1.56	0.67	.512
Changes in cognition and mood	12.53	2.80	13.52	3.12	13.97	1.90	3.14	.047*
Increased arousal and reactivity	11.69	2.21	11.79	1.96	11.78	2.05	0.02	.972
Distress and Interference	3.97	1.30	3.97	1.19	4.28	1.23	0.83	.435
PTSD	41.71	5.20	42.52	4.42	43.54	3.55	1.73	.180

Physical Functioning	60.51	21.96	63.23	23.51	52.14	20.30	2.73	.069
Role limitations due to physical health	71.15	14.94	72.42	15.31	69.04	15.18	0.48	.615
Role limitations due to emotional problems	73.50	21.19	72.54	20.46	69.04	18.61	0.55	.577
Energy Fatigue	55.00	14.86	56.32	16.34	59.28	18.09	0.71	.49
Emotional Wellbeing	38.69	8.68	38.44	8.34	42.05	7.88	2.34	.100
Social Functioning	40.06	19.27	36.76	20.16	39.58	21.89	0.27	.764
Pain	58.39	17.28	58.08	18.70	68.92	18.40	4.62	.012*
General Health	50.21	9.79	49.38	9.57	50.00	10.88	0.06	.938

* **Significant at 0.05 level**

Besides, there was no significant differences noted among COVID-19 survivors with different personality types (sattva, rajas and tamas) in the other areas of health-related quality of life i.e., role limitations due to physical health, role limitations due to emotional problems, energy fatigue, social functioning and general heath and PTSD. Accordingly, except cognition and mood as well as pain all other hypotheses are rejected.

Table 2: Post Hoc analysis of variance in PTSD and health related quality of life

Dependent Variable	(I) Personality	(J) Personality	Mean Difference (I-J)	Std. Error	Sig.
Changes in cognition and mood	Sattva	Rajas	-0.99	0.61	.246
		Tamas	-1.43*	0.58	.040
	Rajas	Tamas	-0.44	0.60	.741
Pain	Sattva	Rajas	0.30	4.25	.997
		Tamas	-10.53*	4.03	.027
	Rajas	Tamas	-10.84*	4.18	.029

* **Significant at 0.05 level**

More specifically, post hoc analysis using Tukey's test in SPSS revealed that COVID-19 survivors with tamas personality significantly differed from sattva personality in changes in cognition and mood. (p=.040; <0.05) and in pain tolerance (p=.027; <0.05). There is a

significant difference between rajas and tamas personality COVID-19 survivors in pain tolerance. (p=.029; <0.05) There were no significant differences seen between COVID-19 survivors with rajas and tamas, and rajas and sattva in changes in cognition and mood.

Discussion

Triguna analysis has identified protective features of cognition (good memory, processing thoughts and tolerating stressors), social (positive social interactions and relationships) and emotional stability that correspond to descriptions of traits under sattva. Contrary presentations of the reviewed variables that may increase PTSD likelihood relate to both tamas and rajas descriptions respectively. (Adam Gadhvi, 2021).

Aruna Mewada et al (2022) conducted a randomized control trial to study Ashtanga Yoga Ethics-Based Yoga Versus General Yoga on Anthropometric Indices, *Trigunas*, and Quality of Life in Abdominal Obesity. By the end of 12 weeks, the AY arm significantly differed from the GY arm in HC ($P = 0.05$) and BMI scores ($P = 0.03$). The AY arm has shown a significant increase in the *sattva guna* ($P < 0.001$) and reduction in the *rajas* ($P < 0.001$) and *tamas gunas* ($P = 0.03$). There was a significant improvement in the physical and social QoL domain, whereas the other variables examined remained insignificant.

Conclusion

This study aims to address the present burning issues associated with the pandemic COVID 19. The variables studied in COVID-19 Survivors help to understand the predetermined factors that enabled in fighting and coping. Further the same understanding can be applied in treating the COVID-19 patients and also to create awareness and build resilience. Personality type provides a framework to enhance the health-related quality of life.

Limitations to the existing research

- Sample size is small.
- Various other independent factors like gender and COVID-19 related factors are not considered.

Direction for future research

- Sample size to be increased proportionately in sattva, rajas and tamas groups.
- Other psychosocial factors contributing to PTSD and health related quality of life can be studied.

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Menarche and the Making of Gendered Bodies: Comparative Ethnographies from a Multi-Community Village

Amrapali Mukherjee*

Abstract

This ethnographic study explores the diverse cultural beliefs, practices, and emotional meanings attached to menarche across Hindu, Muslim, and tribal communities in Ramnagar village, West Bengal. Drawing on fieldwork that included focus groups, interviews, and participant observation, the research reveals how menarche is experienced as a critical threshold to womanhood and reproductive maturity, yet is enveloped in secrecy, silence, and moral regulation. These responses are shaped by intersecting factors of caste, religion, and generation, with purity, modesty, and social risk informing differing logics of concealment. Mothers are key transmitters of both information and silence, while adolescent girls express both anticipation and emotional distress at menarche's onset. Generational shifts are evident, as younger women increasingly negotiate between traditional secrecy and emerging biomedical or media discourses, though silence remains dominant in daily practice. The findings highlight the limitations of hygiene-focused interventions, arguing for culturally nuanced approaches that address moral, emotional, and social complexities. This study contributes to a deeper understanding of menstrual health as a site of cultural negotiation and evolving gender identity in rural India.

Keywords: Menarche, Ethnography, Rural West Bengal, Tradition, Gender

Introduction:

Menstruation is a cyclical biological process unique to individuals assigned female at birth, involving the shedding of the uterine lining and typically occurring every 28 days during the reproductive years. The onset of menstruation, or menarche, marks reproductive maturity and represents a significant life transition (Chrisler & Zittel, 1998). While the biological basis of menarche is universal, its meanings, practices, and emotional resonances vary widely across societies, shaped by cultural traditions, religious doctrines, and community norms (Nanda, 2012; Murcott, 1993).

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Globally, menarche is interpreted in diverse ways. In some contexts, it is celebrated as a rite of passage that confers new social roles. Ceremonies such as the 'Red Tent' in parts of Africa emphasize communal support and empowerment (Goldwasser, 2007), while groups such as the Apache in North America and the Tikuna in the Amazon observe rituals of seclusion and instruction, culminating in public celebration. In contrast, where menstrual blood is considered impure, menarche may be surrounded by secrecy and restriction. The Chhaupadi practice of rural Nepal, which requires menstruating individuals to stay in separate huts, illustrates these beliefs about impurity and spiritual harm (Joshi & Acharya, 2022).

The age at menarche varies considerably, influenced by nutrition, socio-economic status, geography, and overall health. Global trends indicate a decline in average menarcheal age over the past century, often linked to improved living conditions, though disparities persist across and within regions (Parent et al., 2003). Differences are also observed between urban and rural populations, and among groups divided by caste, religion, and class, shaping both bodily experiences and cultural narratives around the transition to womanhood.

In India, menarche carries strong cultural symbolism, with practices differing widely between regions, communities, and social groups. In southern India, ritual bathing, gifting, and feasting may mark the occasion, while in other places it is treated as a private family matter framed within modesty and propriety. These practices are mediated by caste, tribe, and religious identity, intersecting with gender norms, intergenerational traditions, and localized belief systems.

Ramnagar village in West Bengal reflects this diversity: Hindu, Muslim, and tribal groups maintain distinct customs and interpretations of menarche, influencing whether its onset is celebrated, silenced, or regulated through rules and taboos. While schooling, biomedical knowledge, and mass media have introduced shifting perspectives, long-standing traditions continue to shape the cultural significance of menstruation.

Rationale of the Study:

Menarche, while a universal biological event, is experienced and understood in highly diverse ways shaped by culture, religion, caste, and class. In India, policies largely treat menstruation as a hygiene issue, overlooking the secrecy, silence, and moral rules that surround it. Such an

approach flattens differences and risks ignoring the lived realities of girls and women across communities.

Ramnagar village in West Bengal reflects this diversity, where Hindu, Muslim, and tribal groups maintain distinct beliefs and practices related to menarche. These shape whether it is celebrated or hidden, and how expectations and anxieties are passed across generations. Younger girls exposed to schooling and media renegotiate these traditions, while older generations continue to uphold taboos.

This study aims to bridge the gap between biomedical approaches and sociocultural realities, offering a nuanced understanding that can guide more inclusive and culturally sensitive interventions.

Objectives:

- To understand how menarche is perceived as a biological and social threshold linked to reproductive maturity.
- To examine the belief systems that shape secrecy, silence, and moral regulation around menarche.
- To analyze community-wise differences and intergenerational shifts in the beliefs around menarche.

Methodology:

Selection of the Study Area:

The study was conducted in Ramnagar Gram Panchayat, Aushgram II block of Purba Bardhaman district, West Bengal. The site was selected after analysing socio-economic and health indicators from the Census of India 2011 and the District Statistical Handbook. Bardhaman, with a population of 7.7 million comparable to Switzerland ranks 7th among India's districts and has been identified by the Ministry of Minority Affairs as a Minority Concentration District due to below-average socio-economic and basic amenities. Health outcomes also lag behind, with the DLHS-4 (2012–13) reporting high anaemia prevalence (67%) among women of reproductive age.

Within the district, Aushgram II block was chosen for its entirely rural population, high proportions of SC/ST groups, and over half of residents engaged as agricultural labourers

(Census 2011). Female literacy is 53.36%, well below the national rural average, and nearly 45% of households live below the poverty line (BPL Survey, 2005).

Ramnagar GP, one of seven in the block, comprises 15 villages and about 2,200 residents, with Hindus, Muslims, SC, ST, OBC, and General caste groups living side by side (Census 2011). The literacy rate (73.4%) is lower than the state average, with female literacy significantly below male literacy. Agriculture is the main livelihood, supplemented by artisanal and service occupations. Community infrastructure includes three Anganwadi centres, one health sub-centre, and two schools, according to Gram Panchayat records. The nearest urban centre, Guskara, lies 22 km away.

Ramnagar GP's combination of rural isolation, economic marginalisation, heterogeneous caste-religion composition, low female literacy, poor health indicators, and absence of structured sanitary napkin provision under national schemes creates a complex socio-cultural environment for studying menstrual beliefs and practices. Its social diversity and distance from urban influence make it an informative microcosm for exploring community-specific and intergenerational attitudes toward menarche in rural India.

Research Design

This study employed a qualitative ethnographic approach to explore the beliefs, meanings, and practices surrounding menarche across caste, tribal, and religious groups. Ethnography was selected for its capacity to illuminate sensitive, culturally embedded phenomena involving the body, silence, and regulation. Prior research demonstrates its value in South Asian contexts: Jesmin's work in rural Bangladesh revealed everyday negotiations around menstruation, while Johnsdotter and Agardh's study in India showed how immersion and dialogue capture the complexities of gendered rites (Jesmin, 2015; Johnsdotter & Agardh, 2021). Classic anthropological analyses, such as Turner's on rites of passage, further highlight its strength in mapping symbolic negotiations of biological events.

Ethnography thus offered unique depth in uncovering not only customs but also unspoken anxieties, emotional burdens, and generational shifts, enabling authentic engagement with participants' worldviews in Ramnagar.

Data Collection

1. *Reconnaissance Visits:*

Two preliminary visits (Dec 2017, Feb 2018) enabled mapping of 21 '*paras*' (localities), identifying key informants, and building rapport across community segments. Informants included the Panchayat Pradhan and Upa-pradhan, elders from Hindu and Muslim households, health workers, a doctor, PHC staff, a school teacher, and a social worker. Participation in events like Shyama Puja and Harinam Chobbish Pahar further supported community immersion.

2. *Focus Group Discussions (FGDs):*

Seven FGDs (5–8 participants each; 60–90 min) were conducted with separate groups to encourage open discussion. Groups comprised:

- Adolescent girls from the local high school (separated by religion and caste for comfort)
- Mothers from Hindu, Muslim, and Konda tribal groups
- Male community members (youth and elders)
- Key institutional stakeholders (teachers, Anganwadi staff, PHC staff)
- Venues were participant-chosen for privacy and convenience. All FGDs followed structured guides tailored to group type and were audio-recorded and supplemented with detailed notes.

3. *Key Informant Interviews (KIIs):*

Six KIIs captured specialised perspectives:

- A gynaecologist (women's health)
- A faith healer (traditional healing practices)
- A Class 9 student (youth perspective)
- A retired Padma Bhushan-awarded teacher (local history and norms)
- A Maulavi (religious and cultural interpretation)
- The Panchayat Pradhan (local governance and policy insight)
  Open-ended questions explored menstrual customs and belief systems in depth.

4. *In-depth Interviews (IDIs):*

Nine IDIs explored personal narratives and belief systems around menarche and menstruation, including sensitive themes of secrecy and emotional burden. Participants included four married women from diverse caste and religious groups, a male high-school

teacher, an Anganwadi worker, a male college student, a female college student, and a male Hindu priest. IDIs provided confidential, one-on-one spaces for candid sharing.

5. Participant Observation:

Ongoing participant observation was employed across the fieldwork period. This included deliberate participation in daily routines, attending rituals and festivals such as Dol Jatra, Muharram, and Dharmaraj Puja, and observing social interactions and spatial movement rules during menstruation.

Data Analysis

Data from FGDs, KIIs, and IDIs recorded in Bengali were transcribed verbatim and translated into English where necessary. Using grounded theory principles, codes were generated inductively from the data while also applying sensitizing concepts from anthropological literature on ritual and taboo. NVivo software facilitated thematic coding, cross-case comparison, and analysis. Triangulation of findings across methods strengthened reliability. Representative participant quotes were retained to illustrate themes.

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee. Informed consent (with guardian consent for minors) was secured before participation. Confidentiality protocols involved pseudonym use and secure data storage. Care was taken to respect cultural sensitivities and avoid undue intrusion into private matters.

Findings:

Menarche as Biological and Social Threshold

When Should It Begin? Community Beliefs Around Age, Timing, and Regularity of Menarche

In Ramnagar, the age and timing of menarche were perceived as critical indicators of a girl's bodily health and future reproductive capacity. Mothers, more than any other group, reported closely watching their daughters as they approached adolescence, becoming increasingly anxious if menstruation did not occur by the age of 13 or 14. The absence of menarche at what was considered the "right age" provoked a sense of worry that something was

biologically or spiritually amiss. **KK, a 42 year old mother** of two daughters explained: *"If a girl doesn't start her periods by 14, we start getting worried. We wonder if she is weak or if there is some problem in her body. We think, will she be able to bear children later?"*.

This expectation of a normative age for menarche created social pressure on mothers, who felt answerable for their daughters' development. Mothers feared that delayed menarche might draw gossip or judgment from neighbors, who could attribute it to poor nutrition, parental negligence, or even curses. Such anxieties extended to the regularity of menstruation once it began. As **BD, a 46-year-old mother,** observed: *"Her bleeding is not every month. Sometimes there is a gap… and I worry what if it harms her capacity to have children?"*

Faith healers, who were often consulted when menstruation was delayed or irregular, reinforced these fears by framing them in terms of spiritual or supernatural imbalance. One healer explained that when a girl did not menstruate "on time," it meant that *"the womb is drying up like wood, and without treatment, she will not become a mother."* Such statements heightened maternal anxieties, as reproductive ability was equated with both bodily vitality and social worth.

While biomedical science recognizes considerable variation in the timing of menarche across populations, such variation was not accepted in Ramnagar. Instead, a narrow window of "acceptable" onset was imposed, and deviations were interpreted as problems requiring vigilance and intervention. Similar findings have been reported in other South Asian contexts where delayed or irregular menarche is linked to fears of infertility and social stigma (Buckley & Gottlieb, 2004; Chrisler & Zittel, 1998; Sahoo & Panda, 2018; Van Eijk et al., 2016).

Menarche as a Marker of Fertility, Health, and Gendered Identity

Across caste, tribal, and religious groups in Ramnagar, menarche was consistently understood as the threshold of fertility. For mothers, the arrival of menstruation was the clearest sign that their daughters had crossed into womanhood, capable of childbearing and, by implication, ready for the responsibilities associated with adult female identity. As **MG a mother** belonging to a Scheduled Caste community noted: *"Once she starts menstruating, we know she has entered the stage where she can one day become a mother. It is no longer childhood"*.

Men also made this connection, though fewer spoke openly about it. Among the educated, there was some advocacy for recognizing menarche more positively. **JP, a male school teacher,** argued: *"Motherhood, which is an integral part of a woman's life, can only be experienced after attaining menarche. Rather than covering it, it should be celebrated publicly."* Such views, however, were exceptions to the prevailing culture of silence.

Faith healers and priests further reinforced the link between menstruation and fertility. They framed regular bleeding as evidence of a healthy womb and future capacity for motherhood, while irregularity was treated as a sign of imbalance or divine displeasure. The language of *Shukno Badhak* literally a "drying" of the womb was frequently used to describe girls with delayed or irregular cycles, turning menstruation into the ultimate measure of bodily completeness and reproductive worth.

For adolescent girls themselves, the experience of menarche was marked by ambivalence. On one hand, there was anticipation. Out of 33 female respondents, 18 said they had been "waiting" for their first period, hearing from peers that it was the marker of growing up. On the other hand, lack of prior explanation created shock and fear. Ten girls recalled their first period as frightening, with **KR, a 14-year-old** saying: *"I thought I was dying when I saw the blood."* Mothers typically provided pads or cloth with minimal explanation, leaving girls to interpret the experience largely on their own.

This framing of menarche as both a marker of fertility and the foundation of womanhood reflects anthropological theories of rites of passage, in which biological change is transformed into a social reclassification of identity (Van Gennep, 1909; Murcott, 1993). It also supports observations that menstruation is culturally constructed as proof of reproductive potential and bodily well-being, rather than as a neutral physical process (Chrisler & Zittel, 1998). In Ramnagar, menarche thus stands at the intersection of health, fertility, and social adulthood, placing new moral and behavioral expectations on girls from the very moment of first bleeding.

Emotional and Social Burdens of Menarcheal Beliefs

The onset of menarche was experienced not only as a physical event but also as a moment of heavy emotional weight. Mothers carried the primary burden of anxiety, monitoring their daughters closely and worrying about their reputations, fertility, and vulnerability. Fathers,

by contrast, typically remained uninvolved, considering menstruation "women's matters." As **HC, a Hindu priest,** explained: *"Women do not want to talk about this in front of men, and we too don't interfere. We think it is their matter."* This distancing left mothers alone to manage the responsibility and girls to navigate the transition without broader family support. Girls' own accounts reflected a mixture of anticipation, fear, and shame. Some felt excited to join menstruating peers, while others panicked at the sight of blood. One adolescent recalled believing she was "dying" during her first period. Mothers' responses, though practical, often lacked emotional reassurance, consisting of instructions about pads or cloths with little further discussion. This left many girls isolated at the very moment of transition into womanhood.

Mothers' anxieties extended beyond biology to social and supernatural risks. Disclosure of menarche was feared to attract gossip, male attention, or sorcery. **SB, a mother of a teenage girl,** explained: *"If family enemies know, they can do black magic to spoil her fertility. And if boys find out, they may trap her into a relationship and get physically involved."*

These fears show how menarche is framed as a socially dangerous moment requiring secrecy and surveillance. Such concerns reflect what Douglas (1966) described as the logic of "pollution," where bodily transitions blur boundaries and demand strict regulation. They also echo wider studies showing that secrecy and silence around menarche generate shame, confusion, and alienation from the body (Houppert, 1999; Bobel, 2010; Johnston-Robledo & Chrisler, 2013; Singh, 2012). In Ramnagar, the weight of menarche is thus not limited to the adolescent girl but extends to mothers and families, who experience it as a moment of collective vulnerability and heightened moral responsibility.

Secrecy, Silence, and Moral Regulation Surrounding Menarche

Silence as a Cultural and Moral Imperative

Silence surrounding menstruation in Ramnagar is not merely a matter of discretion, but a socially sanctioned practice tied to morality and respectability. Women repeatedly described menstruation as something that "should not be spoken about" in public or mixed company. To speak openly was seen as shamelessness, while silence was equated with decency and proper upbringing. This silence therefore operates as a social code, instructing girls to embody discretion as part of becoming "good daughters."

For instance, **SM, 38 years, Hindu housewife**, recalled how her mother-in-law reprimanded her for casually mentioning her period in front of a male cousin: *"She told me, 'Do not say such things aloud. Men do not need to know about women's blood.' From then on, I learned to remain quiet."* Such remarks illustrate how silence is actively taught and enforced across generations, shaping not only what can be spoken but also how women perceive their own respectability.

Among adolescents, silence was expressed in terms of peer embarrassment. **RA, 14 years, student**, admitted she never discusses menstruation even with her close friends: *"If I say something, they may laugh or tell others. It is better to keep quiet."* Her hesitation shows how silence is internalized early as a form of social safety, protecting against ridicule and gossip.

The cultural logic of silence was also grounded in religious discourse. In Hindu families, menstruation was consistently associated with *ashuddhata* (ritual impurity). This impurity was not confined to temple restrictions but extended to food handling, household interactions, and speech. In Muslim families, silence was framed differently restrictions on *namaz* during menstruation reinforced ideas of uncleanliness and justified keeping the subject hidden. While the ritual vocabularies differed, both communities converged on the idea that silence was necessary to preserve religious order and family honor.

These findings align with ethnographic scholarship. Douglas (1966) highlights how purity and pollution concepts maintain symbolic boundaries, explaining why menstruation is excluded from public discourse. Murcott (1993) described silence in England as part of a moral etiquette regulating female respectability, while Bobel (2010) shows how silence disciplines girls into "appropriate" femininity. In Ramnagar, silence carries this double weight as both a religious obligation and a social discipline producing an environment where menstruation is rendered invisible even while it profoundly shapes everyday practice.

Ultimately, silence emerges not simply as taboo but as a **cultural technology**: a means of regulating speech, behavior, and embodied propriety. By silencing menstruation, communities regulate not only what girls may say but also how they carry themselves, ensuring that their bodily processes remain hidden from male gaze and public scrutiny.

Secrecy as Intergenerational and Gendered Knowledge

Secrecy around menarche in Ramnagar is not only passed from one generation to the next but also strongly structured by gendered expectations. Mothers, aunts, and grandmothers instruct girls that menstruation must remain hidden, both physically and discursively. This instruction often begins with the very first cycle, when girls are warned against mentioning it to brothers, fathers, or male peers.

PD, a 40 years old Hindu mother of two daughters, explained: *"When my elder one started, I told her clearly 'Do not say anything outside. If anyone asks why you are not going to the temple, just say you are unwell.' This is what my mother taught me, and I tell the same to my girls."* Here, secrecy is not only a maternal inheritance but also a gendered practice: mothers instruct daughters to conceal menstruation specifically from male relatives.

Adolescent voices underscored how gender shaped their silence. **NK, a 13-year-old student,** admitted she did not even tell her best friend: *"If I say, she might tell others. Then people will make fun. My mother also told me not to share with friends."* Male siblings were seen as particularly inappropriate audiences. **SD, a 15-year-old student,** explained: *"If my brother knows, he will laugh. Boys don't understand. So, we just say stomach pain."* In this way, secrecy is reinforced not only as a maternal instruction but as protection against male ridicule and the threat of gossip.

Literature on menstruation points to this dual dynamic. Ussher (2006) and Johnston-Robledo & Chrisler (2013) have shown that secrecy is transmitted as a cultural script across generations, while scholars such as Garg & Anand (2015) emphasize that gendered shame particularly the fear of male judgment underpins this silence. In Ramnagar, secrecy thus emerges as a hybrid of generational duty and gendered self-protection, making silence both n inherited obligation and a gendered survival strategy.

Fear, Gossip, and Supernatural Threats as Regulators

Secrecy was further justified through fears of supernatural harm, gossip, and divine displeasure. These fears operated at multiple levels from faith healers warning of black magic to community gossip threatening family honor.

SA, a 45-year-old Muslim homemaker recalled: *"If people know a girl has started [menstruating], some bad-minded persons may do jadu-tona [black magic]. It can spoil her chances of marriage. So, we do not tell anyone."* Here, secrecy is not just about modesty but imagined as necessary protection against external harm.

In another case, **MR, a 16-year-old student**, said she feared that if boys came to know, they would laugh at her and spread gossip: *"Then everyone will talk, and my parents will feel ashamed."* Gossip thus functioned as a disciplinary mechanism, where the potential for humiliation reinforced silence.

Faith healers also reinforced secrecy by linking disclosure with divine punishment. One healer explained that open talk about menstruation displeases deities, potentially leading to infertility or illness. Such narratives ensure that secrecy is bound not only to social order but also to the realm of the sacred.

Ethnographic parallels are visible across South Asia. Lahiri-Dutt (2015) and Crawford et al. (2014) highlight how fears of gossip and ritual danger sustain secrecy, while Douglas's (1966) theory of pollution explains why speech itself can be marked as contaminating. In Ramnagar, these fears were not abstract but experienced as everyday risks that made secrecy a survival strategy for girls and families alike.

Negotiating Menarche across Communities and Generations

Caste, Religion, and Tribal Identity in Belief Systems Around Menarche

Beliefs around menarche in Ramnagar are not uniform; they are structured by caste, religion, and tribal belonging, producing distinct cultural logics of regulation and silence.

Among upper-caste Hindu families, menarche is strongly tied to the ideology of ritual purity. Restrictions on food preparation, entry into kitchens, and access to sacred spaces dominate the discourse. **RM, a 55-year-old Brahmin grandmother,** explained: *"When my granddaughter started, we made sure she did not enter the kitchen or touch the water vessels. That is how our family keeps the house pure."* This illustrates how menarche is positioned within the broader Brahminical order that enforces bodily discipline to maintain ritual sanctity.

Muslim households in Ramnagar, by contrast, regulate menstruation primarily through prayer and religious obligations. Girls are instructed not to pray namaz or touch the Qur'an during menstruation but continue with schooling and domestic work. **AS, 38 years, Muslim mother** of three daughters, said: *"I told my girl, you must not do namaz those days. But she goes to school, studies, does her chores there is no problem in that."* Here, silence and regulation exist, but they are less embedded in ideas of pollution than in religious injunctions, pointing to a different moral universe.

In Santhal and other tribal households, menstruation is acknowledged as a bodily fact but not treated with the heavy ritual prohibitions seen elsewhere. While some restrictions are observed such as not joining communal puja daily life largely continues. **SK, 42 years, Santhal woman,** observed: *"Our girls don't hide much. They may sit aside for worship, but otherwise life is normal. We don't make it a big thing."* Compared to Hindu upper castes, tribal practices show a relative normalization of menstruation, though secrecy and modesty are not absent.

These community-wise differences suggest that while Hindu upper-castes reproduce a strong purity–pollution regime, Muslims emphasize prayer-related regulation, and tribal groups normalize menstruation as routine. This pattern resonates with broader ethnographies that highlight how caste and religion differently mediate menstrual taboos in India (Dube 2001; Jeffery & Jeffery 1996; Nath 2015). In Ramnagar, therefore, menarche becomes a site where community identity and cultural logic are reproduced and contested.

Intergenerational Reconfigurations of Silence in Caste and Community Contexts

Across Ramnagar, silence around menarche is a shared cultural expectation, but the ways it is understood and justified vary across caste, tribal, and religious lines. Within each group, generational differences are evident, with older women framing silence as natural duty and younger girls continuing practices but reinterpreting their meanings.

In upper-caste Hindu households, older women recall menarche as a moment that automatically imposed a regime of purity and pollution. Silence was not explained but simply expected. RC, an elderly woman, noted: *"We were not told anything directly… it was just understood that it should be kept hidden."* BD echoed this normalization: *"We never saw*

anyone else asking or talking about it, so we didn't either." For this cohort, silence is intertwined with caste status and ritual injunctions, such as avoiding the thākurghār or sacred objects. Proverbs like "Brahmins become Shudras and Shudras become Chandals" during menstruation illustrate how menarche inaugurated a standing hierarchy of restrictions (Douglas, 1966; Delaney, 1988). Younger girls, while still compliant, show greater curiosity and impatience with vague replies "you'll know when it comes, don't talk too much about it" suggesting friction between generational scripts of purity and adolescent demands for clarity (Bobel, 2010).

Among Konda tribal households, silence is justified in ecological and economic terms rather than ritual ones. Older women explain that menstruating girls must avoid fields of potol or lonkā because a sudden onset could "ruin the whole patch" and bring wage deductions. KK, 50, explained: *"If it comes suddenly in the fields, the whole patch may be ruined."* Here, secrecy and restraint are less about divine purity than about safeguarding livelihood, echoing findings from other agrarian communities where menstrual practices are linked to fertility of crops and labor discipline (Vatuk, 1980; Buckley & Gottlieb, 1988). Younger Konda girls, however, rarely articulate such reasoning. They imitate restrictions because "others do," indicating that ecological rationales are gradually replaced by conformity to collective village behavior.

In SC and OBC families, secrecy is more closely tied to gossip and the management of reputation. CK, a Kamar mother, described how news of her daughter's menarche spread among neighbors and led the family to hasten her marriage: *"We just handle it within the family… better kept quiet."* Such cases show how silence operates as protection against reputational harm and threats to marriageability, consistent with ethnographic work that documents menstrual secrecy as a strategy of social risk management among marginalized castes (Murcott, 1993; Nath, 2019). Younger women in these groups, especially those engaged in public health or education, complicate this picture. **RS, 25, Subarna Banik and Anganwadi worker,** explained that she speaks openly about menstruation in her professional role but faces resistance at home, where elders insist on silence to avoid gossip. This tension

reflects a generational negotiation incremental openness introduced by younger women without fully breaking from household expectations.

Among Muslim households, silence is framed primarily through modesty (*sharam*) and sexual respectability. Older women emphasize that menarche should not be mentioned in front of men, linking disclosure with a lapse in propriety. KM, 45, observed that discussing menstruation openly could "make people look differently at the girl." Such framing resonates with wider Islamic discourses where menstruation is discussed within the language of privacy and bodily modesty (Hawkins, 2015; Ali, 2018). Younger girls, however, recast this silence less as a religious command and more as etiquette. Some acknowledged using the word "periods" among friends, even while avoiding it at home. Their practices signal a subtle shift from religiously mandated hush to pragmatic discretion within peer culture.

Taken together, these narratives reveal not just continuity in silence but distinct community-wise logics. Older generations naturalize it variously as purity (upper-caste Hindus), livelihood protection (Konda), social risk management (SC/OBC), or modesty (Muslims). Younger generations largely retain the practices but soften their interpretations, treating silence as habit, embarrassment management, or peer conformity rather than conviction. What emerges is a pattern of intergenerational recalibration: practices persist, but rationales drift, confirming Douglas's (1966) argument that ritual systems endure even as their meanings shift, while also echoing Ussher's (2006) observation that secrecy reproduces stigma across generations.

Emerging Influences of Education, Biomedical Knowledge, and Media on Menstrual Beliefs

While secrecy and silence continue to dominate narratives around menarche across communities, newer influences particularly education, biomedical discourses, and media exposure are beginning to reframe how adolescent girls and some younger women interpret menstruation. These influences do not dismantle the older cultural scripts but introduce alternative ways of making sense of menarche, often creating tensions between inherited silence and new vocabularies of openness.

School-based education plays a significant role in this shift. Girls reported learning about menstruation through science textbooks or occasional health education sessions, which provide a biomedical explanation of menarche as a natural physiological process. For instance, **SB, a 14-year-old student,** explained: *"In school they showed us pictures and said it happens to all girls. That's how I understood… at home they don't talk like that."* Such learning introduces menstruation as a universal biological event rather than a community-specific marker of pollution, protection, or modesty. Similar findings have been documented in other parts of India where school-based education, though uneven, opens limited spaces for biomedical framing of menarche (Mahon & Fernandes, 2010; Garg & Anand, 2015).

At the same time, community health workers act as important mediators of biomedical discourse. Anganwadi workers, ASHAs, and NGO field staff bring terms like *periods*, *hygiene*, and *health problem* into local vocabularies, often clashing with older generations' reluctance to use explicit language. **RS, 25, a Subarna Banik Anganwadi worker,** described: *"In my work I explain that it is normal, a body thing… but at home I can't say much because my mother-in-law still says it should not be spoken."* This disjuncture highlights how professional roles expose women to biomedical normalization even as domestic norms continue to enforce silence.

Media exposure, particularly television and mobile phones, introduces yet another layer. Girls referred to advertisements for sanitary napkins, where menstruation is depicted through blue liquid and words like *freedom* and *comfort*. **NK, 13, remarked**: *"In the ads they show girls jumping and playing, but in our house we cannot do that… we have to sit quietly."* Such representations do not erase restrictions but generate a consciousness of difference between media portrayals and lived realities. Similar contradictions between media narratives of empowerment and entrenched restrictions have been noted in global studies of menstrual discourse (Crawford et al., 2014; Johnston-Robledo & Chrisler, 2013).

Despite these new influences, silence remains structurally intact. Girls may use biomedical language in school or with peers but revert to euphemism or avoidance at home. The intergenerational hierarchy ensures that maternal authority and community norms outweigh newer forms of knowledge. Yet, the very act of comparing what is said in school or seen in

advertisements with household practices signals a slow shift: silence is no longer entirely self-evident, but contested, rationalized, and sometimes quietly resisted.

What emerges, therefore, is a layered belief system where education and media provide alternative frameworks, but these coexist uneasily with older cultural scripts. Rather than producing abrupt change, they generate incremental cracks points where younger generations question, reinterpret, or negotiate the inherited silence around menarche. This aligns with wider feminist scholarship that sees the diffusion of biomedical and media discourses not as replacements for traditional beliefs but as new idioms that girls mobilize selectively within local constraints (Ussher, 2006; Bobel, 2019).

Conclusion:

The ethnography of menarche in Ramnagar shows that menstruation is not only a biological transition but also a deeply socialized event through which communities reproduce gendered hierarchies, moral orders, and intergenerational continuities. Rather than a universal "taboo," menarche entails a mosaic of meanings ritual, ecological, reputational, and modesty-based that inscribe bodies with community-specific norms. As a cultural hinge, it anchors girls within long-standing scripts while exposing tensions of generational change.

Silence emerges here not as static absence but as a cultural technology produced to protect, discipline, and legitimize femininity, varying by caste, tribe, and religion. It functions pedagogically, teaching girls appropriate womanhood, yet its fragility is revealed in adolescent questioning and the selective uptake of biomedical discourse.

Intergenerational contrasts point to "semantic drift": practices persist, but their rationales shift from purity or danger in elders' accounts to habit or embarrassment among youth. This echoes anthropological insights that ritual forms endure while meanings transform (Turner, 1969; Douglas, 1966). In Ramnagar, this drift loosens the moral weight of menarche without dissolving its codes.

Schooling, media, and health interventions further complicate menstrual discourse, introducing idioms of normalcy, hygiene, and empowerment. These new framings do not

supplant traditional norms but coexist in tension, as girls negotiate hybrid practices of secrecy, modesty, and openness.

Thus, menarche in rural India is best understood as a site of cultural negotiation, where biological inevitability intersects with community logics, intergenerational pedagogy, and globalizing discourses. Its significance lies in the interpretive work through which girls and families reconcile purity, propriety, and protection with emerging frames of modernity.

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Drivers of Coexistence of Anaemia and Undernutrition Among Women in India: A Multi-Level Multinomial Regression Analysis

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Abstract

Background: Anaemia and under nutrition remain critical public health concerns among Indian women, contributing to adverse maternal and reproductive health outcomes. Despite national initiatives like ICDS and POSHAN Abhiyaan, the coexistence of anaemia and under nutrition (CAU) continues to affect a significant proportion of women of reproductive age, particularly among socioeconomically and regionally disadvantaged groups. While both conditions are individually well-documented, their co-occurrence and common determinants have not been adequately explored. This study addresses this gap by identifying multi-level drivers of CAU using recent, nationally representative data.

Methods: This study utilized data from the third and fifth rounds of the NFHS focusing on non-pregnant women aged 15–49 years with valid haemoglobin and BMI measurements. Anaemia was defined as haemoglobin <12.0 g/dL and under nutrition as BMI <18.5 kg/m². CAU was measured as the co-occurrence of both conditions. Key explanatory variables included socio-demographic, reproductive, and household factors. Multi-level multinomial logistic regression was employed to assess associations, accounting for both individual and community-level influences.

Results: Between 2005–06 and 2019–21, the prevalence of CAU declined from 21.1% to 11.8%, reflecting some progress. However, anaemia alone increased, and anaemia with overweight/obesity also rose sharply, indicating a nutritional transition. Women most at risk for CAU included adolescents (15–19 years), those with no education (ARRR = 1.81), early childbearing (ARRR = 1.05), high parity (ARRR = 1.14), and the poorest economic group (ARRR = 3.36). Scheduled Tribe women and those from eastern and western regions had significantly higher odds. The analysis showed that individual-level factors accounted for most of the explained variance (PCV = 72.2%).

Conclusion: Despite improvements in nutritional status among women, CAU remains a critical challenge, particularly for adolescents, economically marginalized women, and from disadvantaged social groups. Addressing this dual burden requires integrated, equity-driven interventions focusing on girls' education, delayed childbearing, nutrition access, and region-specific strategies. These findings support the need for strengthened, multi-sectoral policies aligned with SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being).

Keywords: Anaemia, Underweight, NFHS, DBM

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Introduction

Anaemia and under nutrition remain among the most critical public health challenges in low- and middle-income countries (Harsha et al., 2024). Globally, anaemia affects an estimated 30% of women of reproductive age, while under nutrition also remains widespread, particularly in South Asia (WHO, 2025). India faces a disproportionate burden of these nutritional disorders. Recent National Family Health Survey (NFHS) data indicate that more than half of all women of reproductive age in India are anaemic and a substantial proportion continue to be affected by under nutrition (IIPS & ICF, 2021).

The persistent high prevalence of anaemia and under nutrition among Indian women has profound health, social, and economic consequences. Anaemia is primarily caused by iron deficiency, poor dietary intake, and infections, and can lead to fatigue, impaired cognitive function, diminished physical productivity, and adverse pregnancy outcomes (Brabin et al., 1998; Griffiths & Bentley, 2001; Let et al., 2024). Similarly, under nutrition, which is commonly assessed by low body mass index (BMI) or chronic energy deficiency, is associated with increased risks of infectious diseases, poor reproductive health, maternal mortality, and reduced quality of life (Arcavi & Benowitz, 2004; Black et al., 2013; Moschovis et al., 2018; Neal et al., 2015).

A notable and concerning aspect is the coexistence of anaemia and under nutrition (CAU) within the same individuals or subpopulations (Darnton-Hill & Coyne, 1998; Dixit et al., 2023; Kushitor et al., 2020; Shrimpton & Rokx, 2013; WHO, 2017). This dual burden is not merely additive but points to shared, multi factorial aetiologies intersecting at biological, socio-economic, and environmental levels. The coexistence further intensifies health risks, complicates clinical management, and makes the design of effective, integrated interventions more challenging (Black et al., 2013; Stauder et al., 2018).

To address these problems, India has implemented a variety of nutrition and health programs, such as the Integrated Child Development Services (ICDS), the National Iron Plus Initiative, and the POSHAN Abhiyaan. While these initiatives have led to some improvements, the pace of progress is slow and implementation at scale remains fraught with challenges (Vollset et al., 2024). The complexity of nutritional issues in India, influenced by socio-economic

inequalities, cultural dietary patterns, and regional disparities, further limits the effectiveness of these singular intervention efforts (Kumar & Barik, 2024).

Existing research often examines anaemia and under nutrition as separate problems, with a relative lack of studies focusing on their co-occurrence and shared determinants (Kumar & Barik, 2024; Prithishkumar et al., 2024). Furthermore, few analyses have explored how multi-level factors ranging from individual and household attributes to regional and contextual influences shape this dual burden, despite the evident disparities across different communities and regions (Parida et al., 2025).

In this context, there is a pressing need for an integrated, multi-level examination of the drivers of coexisting anaemia and under nutrition among women in India. Such research can provide nuanced insights into the overlapping factors involved, inform more effective policy development and implementation, and ultimately help to improve the health and well-being of Indian women. This study therefore employs a multi-level multinomial regression analysis of nationally representative data to identify and quantify the main drivers of the coexistence of anaemia and under nutrition among Indian women. By capturing both individual factors and community-level influences, this research aims to inform comprehensive and regionally adaptable strategies to address this dual burden. Ultimately, the findings will support policy objectives aligned with the Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being).

Methods and Materials

The current study utilizes data from the fifth round of the National Family Health Survey (NFHS-5), conducted in 2019–21, which is a nationally representative large-scale survey implemented by the International Institute for Population Sciences (IIPS) in collaboration with the Ministry of Health and Family Welfare, Government of India (IIPS & ICF, 2021). The NFHS-5 provides comprehensive information on population, health, and nutrition indicators, with a particular focus on maternal and child health, reproductive health, and nutritional status. Data were collected through a stratified, two-stage sample design, covering all states and union territories of India. The present analysis focused on non-pregnant women aged 15–49 years who had complete information on haemoglobin and anthropometric

measurements. After excluding women with missing data, the final analytic sample comprised 660741 women.

The main outcome variable was the CAU with two categories i.e. 1 – women with anaemia and are underweight, and 0 as otherwise. In addition, anaemia was defined according to World Health Organization cut-offs (haemoglobin <12.0g/dL for non-pregnant women). Under nutrition was assessed using BMI, with a cut-off of <18.5 kg/m2 (IIPS & ICF, 2021; WHO, 2025). The covariates included socio demographic factors, reproductive and health factors, and household and community-level characteristics.

Descriptive statistics were used to summarize the characteristics of the study population and the prevalence of outcome categories. Bivariate analyses assessed associations between explanatory variables and outcomes. Multi-level multinomial logistic regression models were employed to identify factors associated with the coexistence of anaemia and under nutrition, accounting for clustering at the primary sampling unit and state levels. Adjusted relative risk ratios (aRRRs) and 95% confidence intervals (CIs) were reported for each covariate. All statistical analyses were weighted using individual sampling weights and performed using Stata version 17.

Results:

Table 1 shows the distribution of the sample by selected characteristics. The majority of the women falls within the 20–29-year age group, making up 30.7% of the sample. Women aged 30–39 years at 28%, while 24.3% are aged 40–49 years follow this closely. The youngest age group, 15–19 years, constitutes 17% of the sample, highlighting a youthful demographic.

Education levels among women show a significant shift toward formal learning, with 50.1% having completed secondary education. However, disparities remain, as 22.9% of women still report having no education. Meanwhile, 15.1% have attained higher education, and 11.9% have primary-level education. This reflects both progress in female education and persistent gaps.

Marital status data reveals that 71.1% of women are currently married, while 24.4% have never been married. A smaller proportion, 4.5%, fall under the category of widowed,

divorced, or separated. In terms of employment, a substantial 69.6% of women are not engaged in any form of paid work, with only 30.4% classified as working.

Looking at fertility patterns, the majority of women had their first child between the ages of 20–29 (55.9%), followed by those who gave birth between 15–19 years (41.6%). A negligible number had their first birth in their 30s or 40s. The number of children ever born shows an even split, with 43.4% of women having fewer than two children, and 43.2% having between two and three children. Only 13.4% of women reported having four or more children.

Household dynamics show that 83.9% of women reside in male-headed households, while only 16.1% are part of female-headed households. Most women (59.4%) live in larger families with more than four members, whereas 40.7% belong to smaller households. Caste distribution indicates that 42.9% of women are from OBC backgrounds, followed by 25.8% from other castes, 22% from Scheduled Castes (SC), and 9.4% from Scheduled Tribes (ST).

In terms of religion, the vast majority of women (81.8%) identify as Hindu, while Muslims account for 13.1% and women from other religions make up 5.1%. Wealth status is relatively evenly distributed across quintiles, with the richest and poorest groups each comprising around one-fifth of the population.

Place of residence data shows a significant rural bias, with 68.1% of women living in rural areas compared to 32% in urban settings. Regionally, the Central (24.5%) and Eastern (23%) parts of India have the largest shares of the female population aged 15–49, followed by the South (20.7%), North (14.1%), and West (14%). The Northeast accounts for the smallest share at 3.8%.

Prevalence of Anaemia, Undernutrition, Overweight and CAU

Figure 1 presents a comprehensive overview of the prevalence of anaemia and nutritional status based on BMI among women aged 15 to 49 years in India. It reveals that anaemia is alarmingly widespread, affecting 57.2% of the population in this age group, while only 42.8% are not anaemic. In terms of BMI, the majority of women fall within the healthy weight range (57.3%), followed by thin/underweight women at 18.7%, overweight at 17.6%, and obese women at 6.4%. This distribution shows that while most women maintain a normal

BMI, a substantial fraction is either undernourished or facing the health risks associated with overweight and obesity. The presence of underweight and overweight women in nearly equal proportions points to the dual burden of malnutrition faced by India both under nutrition and over nutrition exist simultaneously within the population.

When considering the coexistence of anaemia and BMI status among women, the figure 1 reveals the complexity of the issue. Among underweight women, 11.8% are anaemic, while 7% are not. In the overweight or obese category, 12.4% are anaemic compared to 11.5% who are not. Strikingly, even among those with a normal BMI, a significant 33% are anaemic, while only 24.4% are not. This suggests that anaemia is not confined to under nutrition; it also affects those who appear nutritionally healthy or even over nourished.

Figure 1: Prevalence of Anaemia, Underweight and CAU among Women Aged 15 – 49 Years in India, 2019 – 21
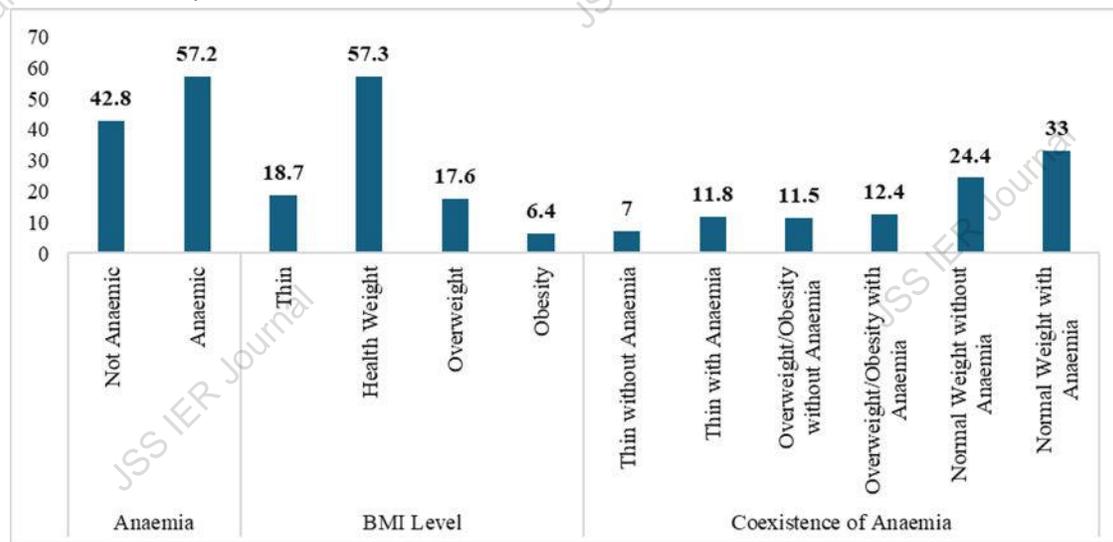
Source: Author calculation

Further, Table 1 reveals the notable disparities in CAU among women, across different socio-demographic and economics groups. The prevalence of CAU is most prevalent among adolescents aged 15–19 years (24.2%) and declines steadily with age, reaching 6.2% in the 40–49 age group. This pattern indicates that younger women are more vulnerable to compounded nutritional deficiencies, possibly due to increased physiological demands during adolescence and the onset of reproductive activity. Education level reveals a complex pattern

where individuals with secondary education have the highest CAU (13.1%), while those with higher education report a lower prevalence (8.1%). Interestingly, women with no education also have a higher prevalence (11.8%) than those with primary education (10.6%), suggesting that while formal education offers some protection, secondary schooling may coincide with age or socioeconomic factors that still place young women at risk.

Marital status significantly influences CAU, with never-married individuals having the highest prevalence (20.6%), in contrast to 8.9% among married individuals and 8.8% among others (widowed, separated, etc.). This pattern may reflect both age-related vulnerabilities and differing levels of nutritional and social support. Employment status shows little variation in CAU, with non-working individuals at 12.0% and working individuals at 11.6%, indicating that employment alone may not be a protective factor

Age at first birth also influences CAU; individuals giving birth between ages 15–19 experience higher CAU (9.4%) compared to those having their first birth later in life, suggesting that early childbirth may exacerbate nutritional deficiencies. Women who have fewer than two children show the highest prevalence of CAU (16.1%), compared to those with 2–3 children (8.0%) and four or more children (9.9%). This may reflect both age-related differences and the cumulative impact of repeated pregnancies and childcare responsibilities on nutritional status.

The sex of the household head shows minimal differences, with female-headed households reporting slightly higher CAU (12.0%) than male-headed ones (11.7%). Larger family size (more than four members) is associated with higher CAU (13.0%) compared to smaller families (10.0%), which may reflect greater resource constraints or care giving burdens in larger households.

Caste-wise, Scheduled Tribes (ST) exhibit the highest CAU at 18.3%, followed by Scheduled Castes (12.9%), Other Backward Classes (11.4%), and Other Castes (9.1%), indicating persistent social inequalities in nutritional health. Religion also plays a role, with Hindus having a higher CAU (12.2%) than Muslims (10.0%) and individuals of other religions (9.2%), possibly due to cultural dietary practices or health service access. Wealth status shows a strong inverse relationship with CAU, ranging from 19.0% in the poorest to 6.0% in the richest, underscoring the critical role of economic status in health outcomes.

Table 1: Distribution of Sample and Prevalence of CAU among the Women Aged 15 – 49 Years by Socio-Demographic Characteristics in India, 2019 - 21

Background Characteristics	Sample Distribution	Prevalence of CAU	Sample
Age			
15 – 19	17.0	24.2	1,12,381
20 – 29	30.7	13.2	2,02,909
30 – 39	28.0	7.4	1,85,233
40 – 49	24.3	6.2	1,60,219
Education			
No Education	22.9	11.8	1,51,270
Primary	11.9	10.6	78,837
Secondary	50.1	13.1	3,30,899
Higher	15.1	8.1	99,735
Marital Status			
Never married	24.4	20.6	1,61,257
Married	71.1	8.9	4,70,076
Others	4.5	8.8	29,407
Occupation			
Not Working	69.6	12.0	75,219
Working	30.4	11.6	32,795
Age at First Birth			
15 – 19	41.6	9.4	1,86,584
20 – 29	55.9	8.2	2,50,554
30 – 39	2.4	5.6	10,767
40 – 49	0.03	3.1	183
Child Ever Born			
Less than 2	43.4	16.1	2,86,847
2 and 3	43.2	8.0	2,85,293
4+	13.4	9.9	88,602
Sex of Household Head			
Male	83.9	11.7	5,54,124
Female	16.1	12.0	1,06,613

Family Size			
Less than or equal to 4	40.7	10.0	2,68,606
More than 4	59.4	13.0	3,92,136
Caste			
SC	22.0	12.9	1,45,165
ST	9.4	18.3	61,896
OBC	42.9	11.4	2,83,556
Others	25.8	9.1	1,70,124
Religion			
Hindu	81.8	12.2	5,40,507
Muslim	13.1	10.0	86,626
Others	5.1	9.2	33,608
Wealth Status			
Poorest	18.5	19.0	1,22,290
Poorer	20.2	14.5	1,33,676
Middle	20.8	11.2	1,37,530
Richer	20.9	8.7	1,37,989
Richest	19.6	6.0	1,29,256
Place of Residence			
Urban	32.0	8.0	2,11,089
Rural	68.1	13.5	4,49,652
Region			
North	14.1	9.5	92,846
Central	24.5	11.7	1,62,033
East	23.0	14.8	1,51,697
Northeast	3.8	10.9	24,873
West	14.0	14.3	92,737
South	20.7	8.5	1,36,556
Total	**100**	**11.8**	**6,60,741**

Source: Author's calculation

Urban-rural differences are evident, with rural residents experiencing significantly higher CAU (13.5%) compared to urban residents (8.0%), likely due to disparities in healthcare access, diet diversity, and awareness. Regional disparities are also notable with the East and West regions have the highest CAU (14.8% and 14.3%, respectively), while the South and North have the lowest (8.5% and 9.5%, respectively). These variations reflect regional

differences in food security, socioeconomic conditions, healthcare infrastructure, and public health interventions.

Overall, the national prevalence of the coexistence of anaemia with underweight stands at 11.8%, with substantial variation across socio-demographic groups. This highlights the need for targeted nutritional and health interventions to address the intersecting burdens of anaemia and underweight, especially among adolescents, rural populations, the economically disadvantaged, and marginalized social groups.

Determinants of Coexisting of Anaemia and Underweight

The study further investigated the factors associated with CAU among women aged 15-49 years in India by using the multi-level multinomial logistic regression models. The estimates of null model in Table 2 showed that about 10.5% of the differences in the CAU came from community-level factors (ICC = 0.105). This meant that where a woman lived things like geography and the local economy had a real impact. When individual-level factors such as age, education etc. were added in Model I, the community-level variation dropped to 0.278, and the ICC went down to 7.8%. That explained over 72% of the variation (PCV), showing that personal characteristics made a big difference. Model II looked at only community-level factors and also reduced the variation, but not as much as Model I. The best overall result came from Model III, which combined both individual and community-level factors. It had the lowest AIC and BIC values, with the ICC falling further to 6.9% and the PCV to 62.8%. This showed that both personal and community factors mattered, but individual-level factors had the bigger influence on women's risk of facing nutritional challenges.

Table 2: Multi-Level Multinomial Logistics Regression Estimates of Double Burden of Malnutrition among Women Aged 15 – 49 Years, India, 2019 -21

Background Characteristics	Null Model	Model I	Model II	Model III
Community Level Variance	0.385	0.278	0.276	0.242
ICC	0.105	0.078	0.078	0.069
PCV	ref	72.2	71.7	62.8
AIC	1036358	659254	1024752	656362
BIC	1036404	659833	1024937	657075

Note: Model 1: Individual characteristics, Model II: Community-level characteristics, Model III: Full model

Table 3 shows, Age turned out to be a key factor when looking at the chances of being CAU. Younger women were clearly more at risk compared to older ones. Women aged 15–19 had

38% lower risk (ARRR: 0.62, p<0.001, CI: 0.58 – 0.67) of being in better nutritional health than those aged 40–49, which shows they were more likely to fall into the anaemia with underweight category. The risk seemed to go down with age, which could be linked to physical development, better access to food and health care, and more stability over time.

Education made a big difference too. Women with no formal education were 1.81 times (ARRR: 1.81, p<0.001, CI: 1.72 – 1.91) more likely to experience CAU compared to those with higher education, and it was not just a sharp divide it followed a clear pattern. Those with just primary education had 1.57 times risk (ARRR: 1.57, p<0.001, CI: 1.48– 1.66), and those with secondary had 1.36 times (ARRR: 1.36, p<0.001, CI: 1.30 – 1.43). All these differences were statistically strong. This shows how education can lead to better awareness of nutrition and health services and may also give women more influence over household decisions, all of which help protect against malnutrition.

Marital status did not have a strong link on its own, but when looking at age at first birth, the connection became clearer. Women who had their first child between the ages of 15 and 19 were at a higher risk. Even those who gave birth between 20 and 29 had slightly higher risk (ARRR: 1.05, p<0.001, CI: 1.03 – 1.08), while women who started later seemed to be at less risk. Early childbirth ARRRs pressure on the mother's body, which supports the push for delayed marriage and motherhood as a public health goal.

The number of children also mattered. Women with four or more kids had a higher risk of CAU (ARRR: 1.14, p<0.001, CI: 1.09 – 1.18) compared to those with fewer than two. Women with two or three children had a slightly lower risk (ARRR: 0.94, p<0.001, CI: 0.92 – 0.97), which suggests that having many children can stretch family resources, especially in lower-income households. Family size and structure played a role too. Women in larger households with more than four members had an 11% higher risk (ARRR: 1.11, p<0.001, CI: 1.09 – 1.14) of being CAU, but whether the head of the household was male or female did not seem to make much difference. This suggests that the size of the family had more of an impact than who was in charge.

Caste was still a strong predictor. Women from STs (ARRR: 1.11, p<0.001, CI: 1.09 – 1.14) were more likely to face CAU, while those from OBCs (ARRR: 0.92, p<0.001, CI: 0.89 – 0.94) and upper castes had lower risk (ARRR: 0.92, p<0.001, CI: 0.89 – 0.95). This points to the deeper structural and social disadvantages that ST women face, including geographic

isolation and limited access to essential services. Religion also showed some interesting patterns. Muslim women (ARRR: 0.72, p<0.001, CI: 0.69 – 0.75) and women from other minority religions (ARRR: 0.55, p<0.001, CI: 0.52 – 0.58) had a lower risk of CAU compared to Hindu women. This might be linked to different diets, cultural habits, or community health practices that helped reduce risk.

Table 3: Predictors of CAU among Women Aged 15 – 49 Years: Multi - Level Multinomial Regression Analysis

Background Characteristics	Model I	Model II	Model III
Age			
15 – 19	0.61*** [0.57 - 0.66]		0.62***[0.58 - 0.67]
20 – 29	0.35*** [0.33 - 0.38]		0.36***[0.33 - 0.39]
30 – 39	0.28*** [0.26 - 0.30]		0.28***[0.26 - 0.30]
40 – 49®			
Education			
No Education	1.80*** [1.71 - 1.90]		1.81***[1.72 - 1.91]
Primary	1.55*** [1.46 - 1.64]		1.57***[1.48 - 1.66]
Secondary	1.37*** [1.30 - 1.44]		1.36***[1.30 - 1.43]
Higher®			
Marital Status			
Never married®			
Married	1.11 [0.83 - 1.47]		1.1 [0.82 - 1.47]
Others	1.29 [0.97 - 1.73]		1.3 [0.97 - 1.73]
Age at First Birth			
15 - 19®			
20 – 29	1.03** [1.01 - 1.06]		1.05***[1.03 - 1.08]
30 – 39	1.04 [0.96 - 1.13]		1.08*[1.00 - 1.17]
40 – 49	0.85 [0.45 - 1.59]		0.91 [0.49 - 1.71]
Child Ever Born			
Less than 2®			
2 and 3	0.95** [0.92 - 0.98]		0.94***[0.92 - 0.97]
4+	1.12*** [1.08 - 1.16]		1.14***[1.09 - 1.18]
Gender of Household Head			
Male®			
Female	1.01 [0.98 - 1.04]		0.99 [0.96 - 1.02]

Background Characteristics	Model I	Model II	Model III
Family Size			
Less than or equal to 4[®]			
More than 4	1.11*** [1.09 - 1.14]		1.11***[1.09 - 1.14]
Caste			
SC[®]			
ST	1.05** [1.02 - 1.09]		1.06**[1.02 - 1.10]
OBC	0.94*** [0.91 - 0.97]		0.92***[0.89 - 0.94]
Others	0.91*** [0.88 - 0.94]		0.92***[0.89 - 0.95]
Religion			
Hindu[®]			
Muslim	0.68*** [0.65 - 0.7]		0.72***[0.69 - 0.75]
Others	0.44*** [0.42 - 0.46]		0.55***[0.52 - 0.58]
Wealth Status			
Poorest	3.57*** [3.4 - 3.74]		3.36***[3.19 - 3.54]
Poorer	2.68*** [2.56 - 2.8]		2.58***[2.46 - 2.71]
Middle	2.10*** [2.01 - 2.2]		2.03***[1.93 - 2.13]
Richer	1.59*** [1.52 - 1.67]		1.54***[1.47 - 1.61]
Richest[®]			
Place of Residence			
Urban[®]			
Rural		1.56*** [1.53 - 1.6]	1.11***[1.08 - 1.15]
Region			
North		0.81*** [0.79 - 0.84]	0.74***[0.71 - 0.77]
Central		1.17*** [1.13 - 1.2]	0.86***[0.82 - 0.89]
East		1.6*** [1.55 - 1.65]	1.20***[1.15 - 1.25]
Northeast		0.6*** [0.58 - 0.62]	0.64***[0.60 - 0.67]
West		1.61*** [1.56 - 1.67]	1.54***[1.48 - 1.61]
South[®]			

Note: ® reference category, *p<0.05, **p<0.01, ***p<0.001,

Economic status stood out as one of the strongest influences. The poorest women (ARRR: 3.36, p<0.001, CI: 3.19 – 3.54) had more than three times the risk of being CAU compared to the richest group. Even those in the middle-income range (ARRR: 2.03, p<0.001, CI: 1.93 – 2.13) were at double the risk. This steep divide makes it clear that improving women's

economic standing could have a big impact on their health. Programs like food subsidies or cash transfers could really help reduce these gaps.

Where a woman lived also made a difference. Rural women had an 11% higher risk (ARRR: 1.11, p<0.001, CI: 1.08 – 1.15) of facing CAU than urban women. Regionally, women in the East (ARRR: 1.20, p<0.001, CI: 1.15 – 1.25) and West region (ARRR: 1.54, p<0.001, CI: 1.48 – 1.61) were worse off, while those in the North (ARRR: 0.74, p<0.001, CI: 0.71 – 0.77) and Northeast (ARRR: 0.64, p<0.001, CI: 0.60 – 0.67) had lower ARRs. These differences likely reflect gaps in infrastructure, public health outreach, and food habits across the country. Targeting these specific areas could help reduce regional health inequalities.

Discussion

This study provides a comprehensive multi-level examination of the drivers of the coexistence of anaemia and under nutrition (double burden) among women in India. The findings highlight substantial progress in reducing the prevalence of anaemia with underweight (CAU) among women aged 15–49 years between 2005–06 and 2019–21, across most socio-demographic groups. However, this improvement coincided with an overall rise in anaemia prevalence and significant increases in overweight/obesity some of whom were also anaemic reflecting a nutrition transition and evolving double burden in India's female population. Our multi-level multinomial regression analysis further illustrates the persistent socio-economic, regional, and community-level disparities in the double burden, despite overall reductions for many population subgroups.

The marked reduction in underweight with anaemia aligns with the impact of India's various nutrition and health programs, such as ICDS and the National Iron Plus Initiative (Kavitha et al., 2022). Improved access to health services, nutrition awareness campaigns, and targeted supplementation efforts likely contributed to this success (Kumar & Barik, 2024). However, the increasing prevalence of anaemia even among women with normal or excess body weight underscores an evolving public health challenge, one which is also noted by the WHO(2025) and IIPS & ICF(2021). This finding resonates with prior evidence suggesting that dietary quality, micronutrient imbalances, and persistent social inequities continue to influence anaemia risk, irrespective of general improvements in BMI (Prithishkumar et al., 2024).

The regression analysis confirms that the double burden disproportionately affects the most marginalized: younger women, those with less education, those in the lowest wealth quintiles,

Scheduled Castes or Tribes, and those living in rural or less developed regions. These patterns corroborate prior studies that have noted persistent social and geographic inequalities in nutritional outcomes for Indian women (Black et al., 2013; Parida et al., 2025). Nevertheless, the observed gradients by education, wealth, and urban/rural residence also indicate areas where multi-sectoral strategies and improved social safety nets could have significant population health impacts (Kumar & Barik, 2024). The regional heterogeneity found in our analysis concurs with earlier work and highlights the need for more context-specific and decentralized programmatic action (Prithishkumar et al., 2024).

Our study adds to a growing body of literature that advocates for the integration of micronutrient supplementation, food security, sanitation, and women's empowerment within a life-course approach to address intertwined nutritional deficiencies (Black et al., 2013). The persistent relative risk among the young, poor, and less educated underscores the importance of focusing on the social determinants of health, alongside clinical and dietary interventions.

Despite substantial gains in reducing underweight with anaemia, this study demonstrates that the coexistence of anaemia and under nutrition remains a complex, multi factorial challenge for India. Efforts must be doubled to address micronutrient deficiencies, ensure dietary diversity and quality, and tackle the social and structural determinants underlying persistent disparities. These findings reinforce the view that only coordinated, multi-level interventions tailored to regional and population-specific contexts will be sufficient to eliminate India's double burden of malnutrition among women.

Conclusion

The study reveals that while the prevalence of the coexistence of CAU among Indian women has declined over the past two decades, it remains a significant public health concern particularly among adolescents, women with low education, early childbearing, and those from marginalized socioeconomic and caste groups. Individual-level characteristics play a stronger role than community-level factors, suggesting that targeted, person-focused interventions can be highly effective. Using a multi-level multinomial regression framework, the analysis shows that individual-level factors such as age, education, parity, household wealth, and age at first birth are more influential than community-level factors in determining women's risk of CAU. The continued vulnerability of rural, poor, and socially disadvantaged populations underscores the urgent need for equity-driven, targeted interventions.

To address CAU effectively, policy efforts must prioritize girls' education, delay early marriage and childbearing, improve reproductive healthcare access, and enhance food and nutrition security in underserved regions. Integrating these strategies into national programs will be essential to achieving SDGs related to hunger, health, and gender equality.

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Ageing, Living Arrangements and Self-Reported Health: Evidences from Four Rounds of the National Sample Surveys

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Abstract

Health is a crucial part of quality of life at all ages. Its salience is felt even more at older ages. Self-reported health is recognized as an indicator of overall health of an individual. Health gets influenced by the environment that includes socioeconomic environment. Therefore, health has its social determinants. Living arrangements are one among prospective social determinants of health. The present study attempts to explore the links between the health and its social determinants in the context of older adults in India. For this purpose, the self-reported health is taken as a measure of overall health status of an individual. Living arrangements are included as one of the social determinants. The information provided by various rounds of the national sample surveys, namely the 52nd, the 60th, the 70th and the 75th rounds is utilized for this purpose. Living arrangements are classified in to five types, namely, LA I (living alone), LA II (living without spouse but with non-relations or other relations), LA III (living without spouse but with children), LA IV (living with spouse only) and LA V (living with spouse and other members). The self-reported health is categorized into three categories, namely, SRH 1 (excellent / very good), SRH 2 (good / fair) and SRH 3(poor) in the order of declining health status. SRH1 and SRH 2 are relatively better states of health. The changes in the distribution of self-reported health are studied over time. Further the distribution of self-perceived health for each living arrangement is studied for changes taking place over time. A multinomial logistic regression model is utilized to explore the association between self-reported health and living arrangement while controlling for the time. Findings indicate significant association between the self-perceived health status and living arrangements of the older adults. Findings indicate that living with spouse or living with spouse and other members at older ages makes older adults more likely to report better states of health when compared to those living alone. Further older adults living without spouse but with non-relations or other relations or those living without spouse but with children are less likely than those living alone to report better states of health.

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Introduction

India's rapidly ageing population presents unique challenges and opportunities for both social policy and research, especially as traditional family structures and living arrangements evolve. The relationship between how older adults live whether alone, with spouse, with children and extended family, or in institutional settings and their health outcomes is critical for policymakers, gerontologists, and health service planners. The National Sample Survey (NSS) offers robust, nationally representative datasets to analyze these relationships in the Indian context.

Early studies recognized living arrangement as a key social determinant for elderly well-being. Rajan (2003) provides foundational context on living arrangements among the Indian elderly, highlighting the pre-eminence of joint family systems. However, with rapid urbanization, migration, and socio-economic transformation, joint family prevalence is declining, leading to more nuclear families and solo living among older adults. Saha & Majumdar (2023), using NSS 71st round data (2014), demonstrate that co-residence with children remains the most dominant arrangement, but the percentage of elderly living alone or only with spouse is rising, especially among women and in urban areas. A substantial body of literature utilizes NSS data, as well as NFHS and LASI, to analyze the effects of living arrangement on health outcomes. Agrawal (2012) and Jadhav et al. (2015) found that elderly individuals living alone are at significantly higher risk of both chronic (asthma, tuberculosis) and acute (malaria, jaundice) illnesses than their counterparts residing with family, even after controlling for socioeconomic status, environment, and behavior. Their research further links solitary living to increased psychological distress, disability, and hospitalizations. Samanta et al. (2015), analyzing Human Development Survey data, reveal that multigenerational households offer the lowest levels of short-term illness for older adults. The health benefit is accentuated when the older individual lives with spouse, adult children, and grandchildren. Conversely, the advantage diminishes in households with only a spouse or spouse and children; elderly living alone are most vulnerable to short-term morbidity and adverse health events. Saha & Majumdar (2023) extend this analysis, showing that self-rated health declines sharply with adverse living arrangements, especially for women and those with lower

education and wealth. The interaction between education level, residence, and living arrangement is particularly notable: elders in rural areas with lower education and income, living without children, are at compounded risk for poor health.

Data and methods

The data pertaining to living arrangements and self-reported health comes from 52nd, 60th, 70th and 75th rounds of the national sample survey. These rounds were conducted during 1995-96, 2004, 2014 and 2017-18 respectively. These time frames are referred to as reference periods in the present study. The sample sizes for the respective rounds after cleaning the data are 31993, 33054, 27234 and 42755 respectively. The self-reported health is recorded as an ordinal variable with categories excellent, very good, good, fair and poor. The present study classifies the states of health as SRH 1, SRH 2 and SRH 3. SRH 1 includes two states namely, excellent and very good. SRH 2 includes the states good and fair. SRH 3 indicates poor state of self-reported health. SRH 1 and SRH 2 are relatively better states of health whereas SRH 3 indicates a worse state of health.

For the purpose of the present study the living arrangements of the older adults are classified into five, namely, LA I, LA II, LA III, LA IV and LA V. LA I includes living alone as an inmate of old age home or not as an inmate of old age home. LA II includes living without spouse but with non-relations or other relations. LA III is about living without spouse but with children. LA IV is a living arrangement where older adults reside with spouse only. LA V indicates with spouse and other members.

Descriptive statistics pertaining to living arrangements and self-perceived health are provided as percentages or proportions. The design of study considers the SRH as dependent variable and living arrangement as predictor. The time in terms of reference periods is taken as a control. Percentages and proportions are utilized to describe the distribution of older adults in selected categories of SRH. SRH, as the variable of prime interest, is analyzed for variation of its distribution across the reference periods.

For a given reference period the distribution of SRH in each of the living arrangements are estimated. Each such distribution is compared with its corresponding distribution in the consecutive reference period using the chi-square test. For example, the distribution of SRH

for LA I is tested for change for the pairs of consecutive reference periods namely, 1995-96 to 2004, 2004 to 2014, and 2014 to 2017-18.

The association between living arrangements and SRH is tested using chi-square test. Cramer's V is utilized as a measure of strength of association. A multinomial logistic regression model is utilized to model association between SRH and living arrangements considering the reference period as a control.

Findings

A profile of respondents

Table 1: Descriptive statistics for the samples

Attributes	1995-96	2004	2014	2017-18
Sample size	31993	33054	27234	42755
Median age	65	65	65	65
Living arrangements				
LA I	3.6	4.5	2.2	2.0
LA II	0.4	4.3	3.1	2.9
LA III	35.9	32.7	30.5	27.0
LA IV	8.4	11.4	10.0	10.6
LA V	51.7	47.1	54.3	57.5
Self-reported health				
excellent / very good	9.9	5.5	6.3	8.3
good / fair	71.7	69.7	67.6	68.8
poor	18.4	24.8	26.0	22.9

LA I: living alone, LA II: living without spouse: but with other relations / non – relations; LA III: living without spouse: but with children; LA IV: living with spouse only; LA V: living with spouse and other members.

It is observed that LA V is the model LA across all the reference periods (Table 1). It is observed that LA V, LA III and LA IV accommodate more than 90 per cent of older adults irrespective of the reference period. The decreasing order of preference of LA is observed to be LA V, LA III and LA IV. The percentage of OAs opting for LA V for the respective

reference periods are 51.7, 47.1, 54.3 and 57.5. Corresponding percentages for LA III are 35.9, 32.7, 30.5 and 27.0 respectively. Similarly, the percentages for LA IV are observed to be 8.4, 11.4, 10.6 and 10.4 respectively. LA I and LA II jointly account for 4.0, 8.8, 5.3 and 4.4 per cent of OAs for the respective reference periods.

Modal state of health is observed to be good/ fair (Table 1 and Figure 1). The percentage of OAs reporting this state of health is 71.7, 69.7, 67.6 and 68.8 respectively for reference periods 1995-96, 2004, 2014 and 2017-18. Excellent / very good state of health was reported by 9.9 percent of OAs in 1995-96. This percentage declined to 5.5 in 2004. However, post 2004 it increased to 6.3 percent in 2014 and 2017-18 it further increased to 8.3.

SRH across living arrangements over the selected reference periods

The distribution of SRH over selected living arrangements for different reference periods are respectively shown in Table 2 and Figure 2. SRH 2 (good / fair) is observed to be modal state of health across all the selected living arrangements and for all the reference periods.

Figure 1: The proportion of different states of self-reported health of older adults acorss selected reference periods. Blue: excellent / very good, Green: good / fair, red: poor
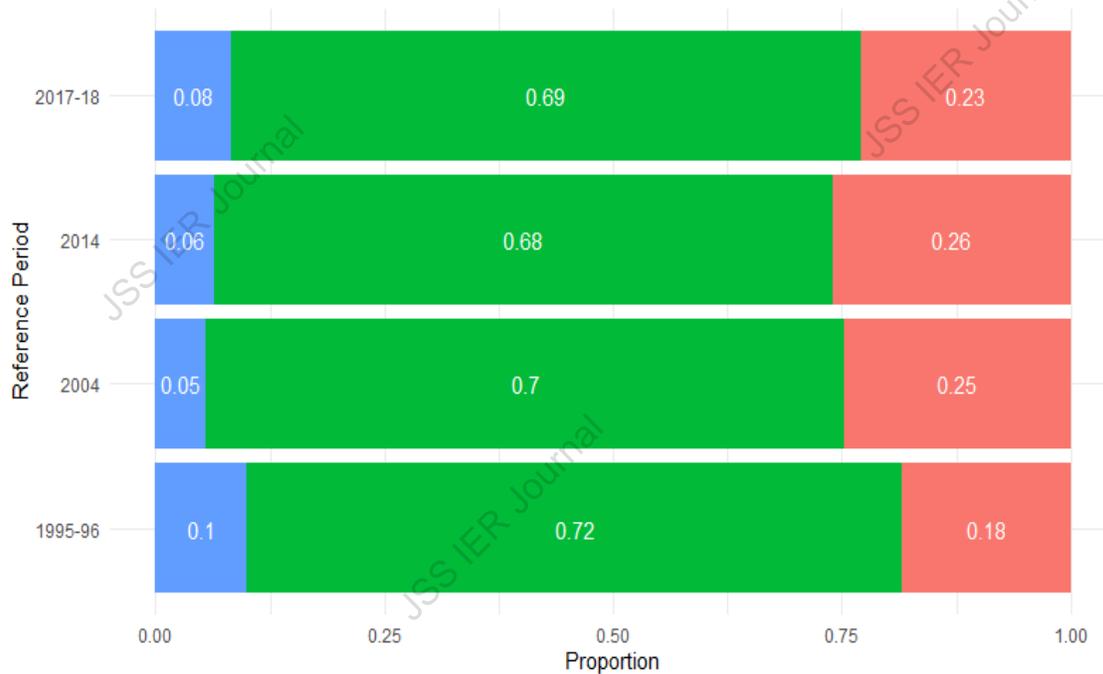
Figure 2: The proportion of different states of self-reported health of older adults for five living arrangements acorss selected reference periods. Blue: excellent / very good, Green: good / fair, red: poor
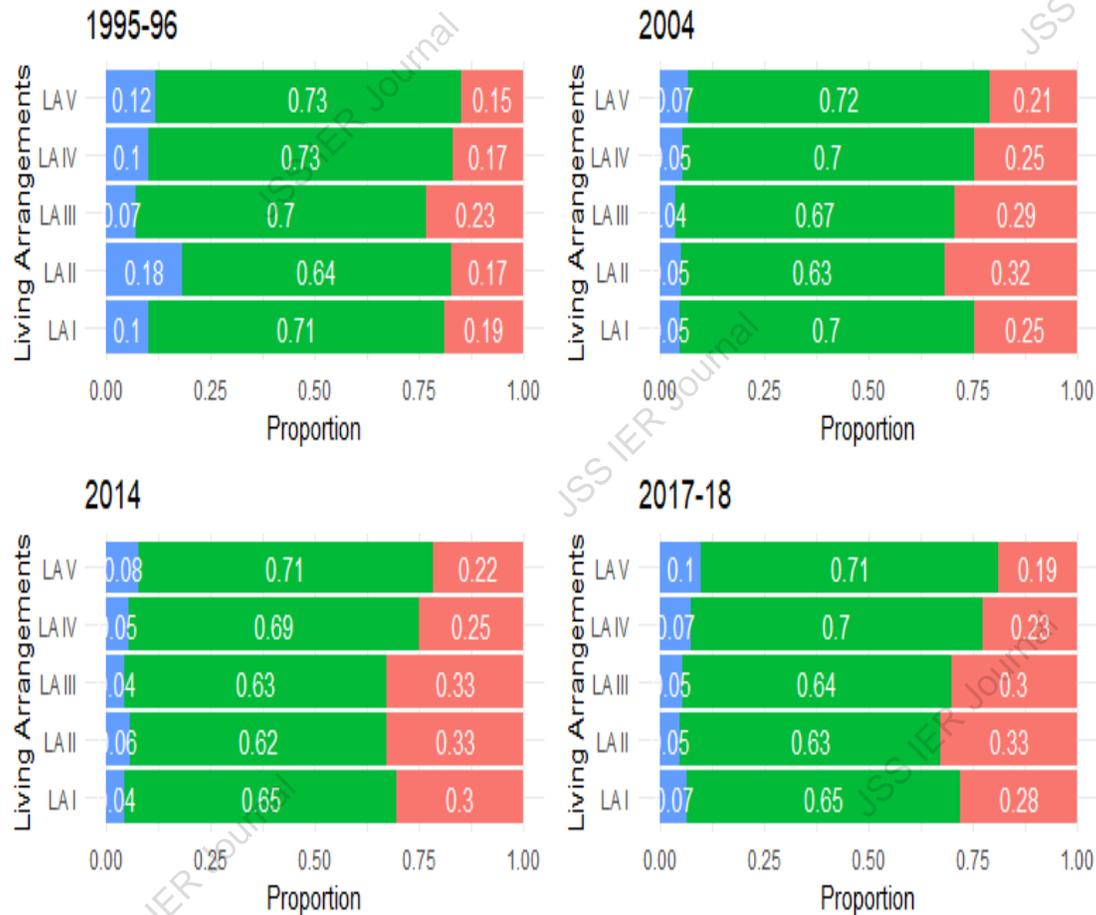
Highest percentage of SRH 3 (poor) is observed in LA V for reference periods 2017-18 (10.43 per cent), 2014 (8.23 per cent) and 2004 (6.66 per cent). Exception was the year 1995-96 when LA II was fund to have highest percentage of older adults reporting SRH 3 (18.18 per cent). SRH 1 (excellent / very good) is found to be highest either in LA II or in LA III varying with the reference period. For reference periods 2004 and 2014 this percentage is 32.08 and 30.87 respectively for LA II. For rest of the reference periods, it is 24.84 (for 1995-96) and 25.47 (for 2017-18) for LA III.

Change in distribution of SRH for each living arrangement for consecutive reference periods

Table 2: Percentage distribution of SRH over selected living arrangements for different reference periods

Reference period	SRH	LA I	LA II	LA III	LA IV	LA V	Chi square p-value	Cramer's V
1995-96								
	excellent / very good	19.16	17.54	24.84	17.94	15.35	< 0.01	0.09
	good / fair	70.31	64.29	68.76	74.11	73.66		
	poor	10.53	18.18	6.39	7.95	10.99		
2004								
	excellent / very good	22.99	32.08	28.35	22.75	19.78	< 0.01	0.08
	good / fair	71.71	63.66	67.87	72.51	73.56		
	poor	5.29	4.26	3.78	4.74	6.66		
2014								
	excellent / very good	21.89	30.87	30.54	18.91	17.65	< 0.01	0.10
	good / fair	72.96	61.76	64.23	75.22	74.12		
	poor	5.15	7.37	5.23	5.87	8.23		
2017-18								
	excellent / very good	25.34	25.23	25.47	16.08	16.49	< 0.01	0.09
	good / fair	67.52	68.81	68.24	75.10	73.07		
	poor	7.14	5.96	6.29	8.83	10.43		
All								
	excellent / very good	22.55	28.73	27.04	18.63	17.21	< 0.01	0.09
	good / fair	70.38	65.71	67.49	74.34	7.53		
	poor	7.07	6.07	5.47	7.03	9.26		

LA I: living alone, LA II: living without spouse: but with other relations / non – relations; LA III: living without spouse: but with children; LA IV: living with spouse only; LA V: living with spouse and other members.

Table 3: Chi-square p-values for comparing distributions of self-reported health for each living arrangement

	1995-96 and 2004	2004 and 2014	2014 and 2017-18
LA I	< 0.01	0.76	< 0.01
LA II	< 0.01	< 0.01	< 0.01
LA III	< 0.01	< 0.01	< 0.01
LA IV	< 0.01	< 0.01	< 0.01
LA V	< 0.01	< 0.01	< 0.01
All	< 0.01	< 0.01	< 0.01

LA I: living alone, LA II: living without spouse: but with other relations / non – relations; LA III: living without spouse: but with children; LA IV: living with spouse only; LA V: living with spouse and other members.

As Table 2 & 3 indicates the distribution of SRH in each of the living arrangement is not the same for all the pairs of consecutive reference periods. The only exception is the distribution of SRH in LA I for 2004 and 2014. In what follows these changes are described in terms of SRH 3 (poor) as any percentage increase / decrease in SRH 3 implies a decrease / increase in better states of health (SRH 1 and SRH 2 combined).

For LA I the percentage of older adults reporting SRH 3 was found to be 10.53 in 1995-96. This percentage declined to 5.29 in 2004 and 5.15 in 2014. In 2017-18 it was 7.14 which was higher than the percentage in 2014. The percentage of older adults reporting SRH 3 was 18.18 per cent in 1995-96 for LA II. It declined to 4.26 per cent in 2004. Thereafter it increased to 7.37 per cent in 2014 and then declined to 5.96 per cent in 2017-18.

The percentage of SRH 3 in LA III is found to be 6.39, 3.78, 5.23 and 6.29 for the consecutive reference periods. In case of LA IV, the percentage of SRH 3 declined from 7.95 in 1995-96 to 4.74 in 2004. Thereafter, an increase in percentage was observed for 2014 (5.87 per cent) and 2017-18 (8.83 per cent). Similarly for LA V, the percentage of SRH 3 declined from 10.99 in 1995-96 to 6.66 in 2004. Thereafter, an increase in percentage was observed for 2014 (8.23 per cent) and 2017-18 (10.43 per cent).

The association between SRH and living arrangements was found to be significant for all the four reference periods (Table 2). The value of Cramer's V was found to be 0.09, 0.08, 0.10 and 0.09 respectively for the four consecutive reference periods (Table 2).

Table 4: multinomial logistic regression model for self – perceived health of older adults with living arrangement and reference periods as predictors

Predictors	excellent / very good vs. poor		good / fair vs. poor	
	Effect (p-value)	**Odds ratios**	**Effect (p-value)**	**Odds ratios**
Intercept	**-1.34 (< 0.01)**	**0.26**	**1.01 (< 0.01)**	**2.76**
Living arrangements				
LA V	0.58 (< 0.01)	1.79	0.32 (< 0.01)	1.38
LA IV	0.17 (< 0.01)	1.18	0.14 (< 0.01)	1.15
LA III	-0.40 (< 0.01)	0.67	-0.18 (< 0.01)	0.83
LA II	-0.27 (< 0.01)	0.77	-0.27 (< 0.01)	0.76
LA I®				
Reference period				
2017-18	-0.13 (< 0.01)	0.87	0.01 (< 0.01)	1.01
2014	-0.62 (< 0.01)	1.86	0.22 (< 0.01)	1.25
2004	-0.31 (< 0.01)	0.73	-0.23 (< 0.01)	0.80
1995-96®				

LA I: living alone, LA II: living without spouse: but with other relations / non – relations; LA III: living without spouse: but with children; LA IV: living with spouse only; LA V: living with spouse and other members.

The multinomial regression model (Table 4) indicates significant association between living arrangements and SRH. The odds in favour of SRH 1 (as compared to SRH 3) are higher for older adults residing in LA V and LA IV (when compared to their counterparts in LA I). The odds are higher by 1.79 times and 1.18 times respectively for LA V and LA IV when compared to LA I. On the other hand, the older adults residing in LA II and LA III have lesser odds in favour of SRH 1 (as compared to SRH 3) when compared to the older adults residing in LA I. the odds are lesser by 0.67 times and 0.77 times for LA III and LA II respectively when compared to LA I.

The living arrangements depict similar patterns for SRH 2 vs. SRH 1 (Table 4). The older adults residing in LA V and LA IV have higher odds in favour of SRH 2 (as compared to

SRH 3) in comparison to the older adults residing in LA I. These odds are higher by 1.38 times for LA V and 1.15 times for LA IV when compared to LA I. However, the odds are found to be lesser by 0.83 times and 0.76 times for LA III and LA II respectively.

Time is also found to show significant association with SPH (Table 4). In comparison to the earliest reference period, i.e. 1995-96, the odds in favour of SRH 1 (as compared to SRH 3) are lesser for the reference periods 2004 and 2017-18. These are lesser by 073 times and 0.8 times respectively. However, for the reference period 2014 the odds are higher by 1.86 times. In case of SRH 2 vs. SRH 3, the odds in favour of SRH 2 (as compared to SRH 3) are higher by 1.25 times and 1.01 times respectively for the reference periods 2014 and 2017-18 (Table 4) as compared to 1995-96. However, the odds are found to be lower by 0.80 times during the reference period 2004.

Discussion and Conclusion

The findings establish that living arrangements are a critical predictor of self-reported health among older Indians. Solo living is consistent marker for vulnerability. While co-residence generally provides protective health benefits, the quality of support and the match between elder preference and actual arrangement determines well-being. As traditional structures fragment, research calls for innovative, inclusive policies that combine the strengths of family, community, and state to safeguard elder health. For the future, continuing and refining NSS data collection on living arrangements, subjective well-being, and elder preferences will remain essential. Integration of these insights into policy and community practice can help build a more supportive and equitable environment for India's ageing population.

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Prevalence and Influencing Factors of Angina Pectoris Among Elderly Through Rose Questionnaire: SAGE India Wave 3 Data Analysis.

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Abstract

This study estimates the prevalence of self-reported angina and symptom-based Rose Questionnaire (RQ) angina and examines the influence of socioeconomic and medical risk factors, using data from the Study on Global AGEing and Adult Health (SAGE), India, Wave 3. The analysis includes 6,719 individuals aged 50 years and above, and all prevalence estimates are adjusted using sample weights. The overall prevalence of self-reported angina is 4.3 percent, while symptom-based RQ angina is much higher at 20.8 percent. The analysis was conducted in two stages. First, chi-square tests were used to examine associations between socioeconomic and medical variables with both types of anginas. Significant variables were then included in logistic regression models to estimate adjusted odds ratios. The results show that self-reported angina increases from 3.2 percent in the 50–60 age group to 6.1 percent among those aged 71 and above, a difference that is statistically significant (χ^2 = 19.8, p < .05). Symptom-based RQ angina similarly increases from 19.2 percent to 24.9 percent across the same age groups. Self-reported angina is higher among males than females (5.6 percent vs. 3.2 percent), and this difference is highly significant (χ^2 = 23.4, p < .001). In contrast, RQ angina is slightly higher among females than males (21.8 percent vs. 19.8 percent), though this difference is not statistically significant. Logistic regression results show that individuals aged 71 and above have higher odds of angina in both self-reported and symptom-based models. while females have higher odds but not significant (AOR = 1.093, NS) in the RQ angina model. Among medical risk factors, chronic lung disease and hypertension emerge as consistently significant predictors across both definitions of angina.

Introduction

Angina, or angina pectoris, is characterized by a sensation of chest tightness or pressure resulting from insufficient blood supply to the heart muscle. It is particularly common in older adults and has a substantial impact on quality of life. Several studies have reported angina as a frequent clinical manifestation of coronary heart disease (Hemingway H. et al., 2008; Welén Schef K. et al., 2023).

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A cross-sectional study using data from the *Longitudinal Ageing Study of India* (Ahmed W, et.al, 2003) among individuals aged 45 and above revealed that 4.69% older males and 7.02% older females had symptom-based angina. Finding from Swedish CArdio Pulmonary biolmage Study (SCAPIS) based on 28,974 subjects revealed that 3.5% reported having angina and further it is proved by using coronary computed tomography angiography (CCTA) that 11.8% of angina subjects had obstructive coronary atherosclerosis (Welén Schef K, et al, 2023).

Data from the 2019 National Survey of Health in Brazil (Debor Carvalho Maita et al., 2021) indicated a prevalence of 8.1% for mild angina (grade I) and 4.5% for moderate to severe angina (grade II), with both forms occurring more often in women (9.8% and 5.5%, respectively). In the United States, analysis of National Health Interview Survey (NHIS) data from 2019 to 2023 showed that the prevalence of self-reported angina remained stable between 1.5% and 1.7%. Rates were higher among men (1.8%) and adults aged 75 and above (4.5%) (Agho A. V., Disu F., Figueroa A. S. et al., 2025).

The above cited research studies and Population based epidemiological studies have measured angina through Rose questionnaire method. Several studies(Rathnayake et al, 2020, Welén Schef K, et al, 2023, Masum Poudel et al., 2019, Rahman, MA,2013) have compared Rose questionnaire findings with the clinical assessment such as EC Gand established association between questionnaire-based angina and Chronic Heart Disease (CHD). Hence, estimating the prevalence of angina in different settings and its risk factors forms a health issue in a given community.

Hence, in this research work an attempt is made to analyse the data of older population collected from *Study on Global AGEing and Adult Health (SAGE)* to derive the prevalence and the factors associated with angina among elderly (50 years and above) based on Rose questionnaire data.

Data and Methodology:

Study on Global AGEing and Adult Health (SAGE) is a collaborative project of the International Institute for Population Sciences (IIPS), Mumbai and World Health Organisation (WHO), Geneva. SAGE is a longitudinal study collecting data on adults aged

50 years and older, from nationally representative samples in China, Ghana, India, Mexico, Russian Federation and South Africa. In India, SAGE was conducted in six states - Assam, Karnataka, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal. SAGE Wave 3, India survey was conducted in 2019-2020 and covered 6073households and 7885individual interviews (Sekher, T.V, et al., 2024). Detailed information on the survey design, instruments used, reports and data can be accessed from International Institute for Population Sciences website (IIPS). For the present study, data were analysed from a sample of 6719 elderly individuals (aged ≥50 years) from SAGE India wave 3.

Information about socio-economic variables viz: age, sex, education level, religion, place of residence, wealth quintile, ever used tobacco, ever consumed alcohol, Diabetes, Chronic lung diseases, Asthma, Hypertension, has been collected to calculate influence of these variables on self-reported angina and symptomatic angina. The *self-reported* angina has been collected by "*yes*" to question as "has health care professional/doctor ever told you that you have angina or angina pectoris (a heart disease)?". Further *symptom-based angina* was derived from Rose questionnaire data.

SAGE followed WHS modified Rose angina questionnaire (Rose, G.A., 1962) and asked all survey participants about symptoms experienced within the prior 12 months following questions: "*1. Pain or discomfort in your chest when you walk uphill or hurry? 2. Pain or discomfort in your chest when you walk at an ordinary pace on level ground? 3. What do you do if you get it while you are walking? (Affirmative response = "stop or slow down" or "carry on after taking a pain-relieving medicine that dissolves in your mouth") 4. If you stand still, what happens to it? (Affirmative response = "relieved") 5. Where is the pain? (Affirmative response = upper or middle chest, lower chest, or left arm)"*. Definite angina was defined as affirmative answers to either question one or two and specified answers to all of questions three to five. Further Rose Grade-I is classified under "pain occur when walk up hill or in hurrying" and Rose Grade-II as "Pain also occurs when walking ordinary pace on level ground".

Initially the association between socio-economic variables such as age, sex, ever been to school, Religion, Place lived, Wealth quintile, ever used tobacco, ever consumed alcohol and

medical condition risk factors such as Diabetes, Asthma, and Chronic Lung Disease, Hypertension, with *self-reported angina* and *symptom-based angina* (RQ Angina) has been established by applying chi-square test. The significant variables considered for further analysis.

At the second stage to estimate the prevalence and influence of risk factors, multivariable statistical analysis has been carried out between selected covariates (Socio-economic variables and medical condition risk factors) and the likelihood of *self-reported angina*, *symptom-based angina* has been analysed by using logit regression and analysis has been carried out with Model I consisting socio-economic variables and Model-II along with medical condition risk factors by considering self-reported angina and symptom-based RQ angina as dependent variable and adjusted Odds ratios (AORs) were estimated to understand the influence of risk factors among elderly.

Results

Prevalence of Angina

Prevalence of self-reported angina was 4.3 percent and it was RQ angina 20.8 percent (Table 1) among elderly in total sample. Detailed probing questions by Rose questionnaire showed greater accuracy in identifying angina among elderly. RQ angina is further classified as Grade-I and II on the basis of its reported intensity of the angina. It was observed (Table 1) 25.8 percent and 19.8 percent Grade-I and Grade-II angina respectively. Grade-II angina estimates are very close to prevalence of definite angina. This indicates that Grade-II angina cases should be considered for further clinical assessment for CHD.

Table 1: Prevalence of self-reported and RQ angina in India among elderly: SAGE wave 3 India data

Angina	Prevalence or Percent	n	N
Self-reported Angina	4.3	291	6719
RQ Angina	20.8	1097	5528
Rose Grade-I Angina	25.8	1548	6002
Rose Grade-II Angina	19.8	1333	6719

Prevalence of Angina by socio-economic covariates:

Self-reported angina among elderly adults (Table 2) shows a relatively low *overall prevalence* of 4.3 percent, but symptom-based RQ angina is much higher at 20.8 percent. Across age groups, both indicators show an increasing trend with advancing age. Self-reported angina rises from 3.2 percent in the 50–60 age group to 6.1 percent among those aged 71 and above, and this age association is statistically significant (χ^2 = 19.8, p<.05). Similarly, RQ angina increases from 19.2 percent to 24.9 percent across the same age groups. This pattern suggests that the oldest adults are more likely to experience angina symptoms even if they do not always report it voluntarily.

Gender differences (Table 2) appear only in self-reported angina. Males report angina at 5.6 percent compared to 3.2 percent among females, and this association is highly significant (χ^2=23.4, p<.001). However, RQ angina is slightly higher among females (21.8 percent) than males (19.8 percent), but the difference is not statistically meaningful. This contrast suggests that women may underreport symptoms, or men may be more likely to label their discomfort as chest pain.

Education and Religion show (Table 2) no meaningful association with self-reported angina, but RQ angina is significantly. This could point toward differences in awareness, reporting ability, or underlying health status. Urban-rural differences are more prominent for RQ angina. While self-reported angina does not significantly differ by residence, RQ angina is markedly higher in rural areas (22.4 percent) compared to urban areas (17.4 percent). This may reflect disparities in healthcare access, diagnosis, or untreated cardiovascular risk.

Wealth gradients are clearly visible in self-reported data. Those in the lowest wealth quintile report angina least (2.4 percent), while the highest two quintiles report above five percent, and this association is highly significant. However, for RQ angina, there is no significant wealth effect; prevalence ranges between 17.8 and 23.9 percent without a clear pattern. To minimise variation in prevalence of angina, these five categories grouped into three as Low, Middle and High wealth gradients for further analysis explaining power may increase in determining angina.

Use of tobacco does not show any association with either measure, and prevalence remains similar between users and non-users. Alcohol use shows a significant effect on self-reported angina: those who consumed alcohol report angina at 7.6 percent versus 4.0 percent among non-users. For RQ angina, the small difference between alcohol users and non-users is not statistically relevant. This insignificant association reveals that in Indian condition use of tobacco and alcohol may be decreasing.

Table: 2: Prevalence of Self-reported and Symptom based RQ Angina among elderly and association with socio-economic risk factors in India: SAGE Wave -III data

Risk factors		Self-reported Angina CI with sig		Symptom based RQ Angina CI with sig	
Age group		Angina	LL-UP	RQ Angina	LL-UP
	50-60	3.23	[2.41 - 4.32]	19.16	[16.27 - 22.41]
	61-70	4.41	[3.48 - 5.59]	20.11	[17.60 - 22.87]
	71+	6.09	[4.31 - 8.53]	24.85	[21.05 - 29.09]
	$\chi^2 =$	19.831*		17.181 NS	
Gender					
	Male	5.59	[4.44 - 7.03]	19.79	[17.38 - 22.43]
	Female	3.19	[2.52 - 4.04]	21.78	[19.25 - 24.53]
	$\chi^2 =$	23.384***		3.3126 NS	
Ever Been to School					
	Yes	4.75	[3.81 - 5.90]	19.03	[16.56 - 21.78]
	No	3.71	[2.86 - 4.81]	23.29	[20.90 - 25.88]
	$\chi^2 =$	4.305 N. S		14.830 *	
Religion					
	Hindu	3.98	[3.31 - 4.78]	20.54	[18.59 - 22.64]
	Muslim	6.09	[3.73 - 9.79]	23.31	[18.68 - 28.68]
	Others	6.18	[3.73 - 10.06]	20	[14.39 - 27.10]
	$\chi^2 =$	9.549 NS		2.5661 NS	
Place living					
	Urban	5.2	[3.63 - 7.41]	17.42	[13.32 - 22.46]
	Rural	3.9	[3.31 - 4.60]	22.42	[20.82 - 24.10]
	$\chi^2 =$	5.869 NS		18.181*	
Wealth Quintile					
	Lowest	2.35	[1.42 - 3.85]	23.89	[20.46 - 27.71]
	Second	3.89	[2.66 - 5.66]	22.03	[17.21 - 27.74]
	Middle	3.37	[2.28 - 4.96]	17.79	[14.19 - 22.06]
	Fourth	5.65	[4.06 - 7.81]	19.86	[16.63 - 23.53]
	Highest	5.73	[4.15 - 7.87]	20.78	[17.21 - 24.86]
	$\chi^2 =$	28.3486 **		13.1133 NS	
Ever used tobacco					
	Yes	4.52	[3.60 - 5.66]	20.76	[18.31 - 23.44]
	No	4.17	[3.28 - 5.27]	20.86	[18.46 - 23.49]
	$\chi^2 =$	0.4823 NS		0..0088 NS	
Ever Consumed Alcohol					
	Yes	7.56	[5.03 - 11.21]	20.05	[15.61 - 25.38]
	No	3.98	[3.31 - 4.78]	20.91	[19.01 - 22.93]
	$\chi^2 =$	17.3011 **		0.2119 NS	
Total		4.3	[3.63 - 5.09]	20.82	[19.05 - 22.72]
n		291		1097	
N		6719		5528	

NS: Not significant, *p<.05, **p<.01, ***p<.001, n=Angina sample, N= elderly age>50 years

Prevalence of Angina by Medical condition risk factors:

Prevalence of self-reported and symptom based RQ Angina with the medical risk factors such as Diabetes, Chronic lung disease, Asthama, Hypertension is given in Table 3. The Self-reported angina shows notable variation across medical risk factors among the elderly in India. Individuals with diabetes report angina at more than double the rate of non-diabetics (8.16% vs. 3.74%), and this difference is statistically significant (35.36, p<.01). However, when angina is assessed using the symptom-based RQ method, diabetes does not show a significant association. Chronic lung disease presents (Table 3) the highest prevalence of both self-reported and RQ angina. Elderly individuals with chronic lung disease report angina at 16.43%, which is nearly four times higher than those without it. The RQ-based angina prevalence is also high at 43.2% among those with chronic lung disease versus 20.38% among those without. Both self-reported and symptom-based angina are highly associated with chronic lung disease, supported by strong chi-square significance (χ^2 =33.14, p<.001).

Table: 3: Prevalence of Self-reported and Symptom based RQ Angina among elderly and association with medical condition risk factors in India: SAGE India Wave -3 data

Risk factors		Self-reported Angina	CI with sig	Symptom based RQ Angina	CI with sig
		Angina	LL-UP	RQ Angina	LL-UP
Diabetes					
	Yes	8.16	[5.93 - 11.12]	21.85	[17.46 - 26.98]
	No	3.74	[3.07 - 4.55]	20.67	[18.76 - 22.73]
	$\chi^2 =$	35.362* **		0.517 NS	
Chronic Lung Disease					
	Yes	16.43	[9.75 - 26.34]	43.2	[30.88 - 56.41]
	No	4.07	[3.41 - 4.85]	20.38	[18.60 - 22.29]
	$\chi^2 =$	46.409 ***		33.141***	
Asthama					
	Yes	7.58	[4.42 - 12.67]	28.86	[22.11 - 36.70]
	No	4.11	[3.44 - 4.90]	20.35	[18.53 - 22.31]
	$\chi^2 =$	10.259**		12.630 **	
Hypertension					
	Yes	7.97	[6.39 - 9.89]	26.38	[23.19 - 29.84]
	No	2.8	[2.17 - 3.62]	18.52	[16.43 - 20.82]
	$\chi^2 =$	89.670 ***		42.853***	
Total		4.3	[3.63 - 5.09]	20.82	[19.05 - 22.72]
n		291		1097	
N		6719		5528	

NS: Not significant, *p<.05, **p<.01, ***p<.001, n=Angina sample, N= elderly age>50 years

Asthma shows a similar pattern (Table 3), with self-reported angina at 7.58% compared to 4.11% among non-asthmatics. Symptom-based RQ angina is also higher for those with asthma (28.86% vs. 20.35%). The associations for asthma are statistically significant for both measures.

Elderly with Hypertension shows nearly 8% self-reported angina among hypertensives versus only 2.8% with those without hypertension. RQ-based angina prevalence is also significantly higher among elderly with hypertensives (26.38% vs. 18.52%).

These findings from Table 3 indicate that chronic conditions, particularly hypertension and lung-related diseases, strongly influence both perceived and symptom-based angina. Overall, chronic lung disease and hypertension show the most consistent and robust associations across both angina measures.

Socio-economic and Medical Condition risk factors influencing Angina

The influence of set of socio-economic variables and medical risk factors on angina has been assessed by calculating adjusted odds ratio for self-reported angina and RQ angina cases using logit regression. The adjusted odds ratios were derived using two models: Model I, which included only socio-economic variables, and Model II, which included both socio-economic variables and medical risk factors. The results are presented in Table 4

Comparing the self-reported angina and symptom-based angina using two models (Model-I and Model-II) across various socio-economic and medical risk factors (Table 4) the SAGE analysis reveals that Age is a significant factor. Individuals aged 71+ have notably higher odds of angina in both self-reported and symptom-based models. Gender difference was observed and females report lower odds (.0619, .576, p<.05) than male in self-reported angina, while female show significantly higher odds (1.093, p<.01) in symptom based RQ angina.

Other socio-economic factors such as Religion, Place lived, wealth quintile and ever used tobacco showed higher odds and ever consumed alcohol with lower odds than their counter part in symptom-based angina but statistically not significant (Table 4).

Among the medical condition risk factors, it has been observed that elderly who has reported "yes" to Diabetes or Chronic Lung Disease or Asthama or Hypertension showed significant higher odds than their counter part in Model -II. Among these four medical risk factors Chronic lung disease and Hypertension are strong predictors in both models (Table 4). Medical conditions like chronic lung disease and hypertension are consistently significant predictors across both angina definitions.

Table 4: Logit regression results of adjusted odds ratio of the socio-economic and medical condition risk factors by self-reported and Symptom based RQ angina among elderly: SAGE India wave 3 data.

Risk factors		Self-reported Angina				Symptom based RQ Angina			
		Model-I		Model-II		Model-I		Model-II	
Socio-economic Age group		Adj.odds ratio	CI LL-UP	Adj.odds ratio	CI LL-UP	Adj.odds ratio	CI LL-UP	Adj.odds ratio	CI LL-UP
	50-60	1.000		1.000		1.000		1.000	
	61-70	1.344	[0.893 - 2.022]	1.151	[0.761 - 1.739]	1.055	[0.818 - 1.361]	0.992	[0.782 - 1.26]
	71+	1.832*	[1.131 - 2.967]	1.615*	[0.998 - 2.615]	1.393**	[1.11 - 1.748]	1.32*	[1.057 - 1.65]
Gender									
	Male	1.000		1.000		1.000		1.000	
	Female	0.619*	[0.406 - 0.945]	0.576*	[0.366 - 0.906]	1.093*	[0.851 - 1.402]	1.064	[0.814 - 1.39]
Ever Been to School									
	Yes	1.000		1.000		1.000		1.000	
	No	1.092	[0.71 - 1.678]	1.108	[0.71 - 1.729]	1.135	[0.797 - 1.615]	1.130	[0.781 - 1.636]
Religion									
	Hindu	1.000		1.000		1.000		1.000	
	Muslim & others	1.745**	[1.171 - 2.6]	1.732**	[1.153 - 2.602]	1.104	[0.839 - 1.452]	1.099	[0.84 - 1.436]
Place lived									
	Urban	1.000		1.000		1.000		1.000	
	Rural	0.819	[0.54 - 1.242]	0.914	[0.604 - 1.383]	1.329	[0.945 - 1.868]	1.368*	[0.946 - 1.979]
Wealth Quintile									
	Low	1.000		1.000		1.000		1.000	
	Middle	1.074	[0.636 - 1.815]	1.037	[0.605 - 1.778]	0.752	[0.559 - 1.012]	0.737	[0.548 - 0.992]

High	1.806**	[1.228 - 2.655]	1.47	[0.97 - 2.228]	0.951	[0.665 - 1.358]	0.869	[0.609 - 1.24]
Ever used tobacco								
Yes	1.000		1.000		1.000		1.000	
No	1.221	[0.849 - 1.758]	1.193	[0.824 - 1.728]	1.030	[0.816 - 1.301]	1.042	[0.828 - 1.312]
Ever Consumed Alcohol								
Yes	1.000		1.000		1.000		1.000	
No	0.517	[0.31 - 0.862]	0.573*	[0.342 - 0.963]	0.982	[0.688 - 1.401]	1.048	[0.733 - 1.5]
Medical Risk factors								
Diabetes								
Yes			1.000				1.000	
No			0.66*	[0.437 - 0.997]			0.988	[0.697 - 1.402]
Chronic Lung Disease								
Yes			1.000				1.000	
No			0.309***	[0.167 - 0.572]			0.379**	[0.214 - 0.672]
Asthama Yes			1.000				1.000	
No			0.764	[0.38 - 1.537]			0.725*	[0.516 - 1.018]
Hypertension Yes			1.000				1.000	
No			0.395***	[0.264 - 0.591]			0.627***	[0.485 - 0.811]

*p<.05, **p<.01, ***p<.001

Conclusions and discussion

The Rose questionnaire (RQ) was introduced in 1962 (Rose, GA,1962) as a standardized method of measuring angina and myocardial infraction in population survey. The performance of RQ has been tested in South Asian and European population residing in Newcastle, UK (Fischbacher C.M. et. al., 2001). The study revealed that the performance of RQ across the ethnic groups in UK achieved greater accuracy in identifying Possible Rose angina than definite angina. Research studies carried out in Rural India by Kutty, V.R et al 1993, Singh R.B, Sharma J., Rostogi V et al., 1997, and Italian study done by Krog V., et al (1991) revealed that the diagnosis of angina on RQ predicts morbidity and mortality and

measures disease burden. Numerous studies have been carried out to test the validity of RQ (Blackwelder W et al; 1981, Lundman T et al., 1971) concluded that there is no agreed "gold standard" to validate RQ measure of angina, however identified as a best tool to measure angina in population-based studies.

SAGE is a large-scale household survey designed by World Health organised and conducted by International Institute for Population Sciences, focusing on the health and well-being of adult population aged 50 years and above with household population 18-49 years (India National report, SAGE Wave 3, T.V. Sekher et. al.,). Rose questionnaire method adopted in SAGE surveys and the data is suitable to estimate the prevalence of angina pectoris.

Analysis of SAGE India wave 3 data reveals that Prevalence of Symptomatic RQ angina of total sample of elderly was 20.8 and varies 19.2 to 24.9 between the age groups from 50-60 to 70+. RQ angina is slightly higher among females (21.8 percent) than males (19.8 percent), but the difference is not statistically significant. Among the medical condition risk factors Chronic lung disease and Hypertension are strong predictors in both models (socio-economic variables and along with medical risk factors). Medical conditions like chronic lung disease and hypertension are consistently significant predictors which across both angina definitions.

Angina, which is a symptomatic condition for heart disease measured through RQ should be considered as tool in epidemiological studies to detect and measure angina pectoris and supportive clinical studies should be undertaken to diagnose Chronic Heart Disease in individual.

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