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## Metabolic Health and the Future of Public Health

Annarao Kulkarni<sup>1</sup>, Poojitha S<sup>2</sup>

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### What Is Metabolic Health?

Metabolic health is more than mere absence of disease. It reflects the efficient and balanced functioning of the body's fundamental biochemical systems—energy production, nutrient utilisation, hormonal signalling, and cellular regulation. A metabolically healthy individual maintains normal blood glucose, favourable lipid levels, healthy blood pressure and waist circumference, and, importantly, adequate insulin sensitivity without relying on medication.<sup>1</sup>

Metabolic health is commonly defined as the absence of all components of metabolic syndrome (MetS): Central obesity, Hypertension, Hypertriglyceridaemia, low HDL cholesterol, and Impaired fasting glucose.<sup>2</sup> By this standard, fewer than one in eight adults globally are truly metabolically healthy.

India particularly faces a rapid metabolic transition. Urbanisation, reduced physical activity, ultra-processed foods, chronic stress, and changing lifestyles have created a population vulnerable to metabolic dysfunction, often at lower body mass indices than Western populations because of a greater tendency for visceral fat accumulation.<sup>3</sup> This shift represents one of the most important public health challenges of our time.

### Metabolic Ill Health: The Central Public Health Crisis

Metabolic dysfunction underlies a substantial proportion of non-communicable disease (NCD) burden

worldwide. A useful framework is the “insulin resistance tree.” Insulin resistance develops in a biological environment shaped by excess refined carbohydrates, ultra-processed foods, inactivity, poor sleep, and chronic stress. Through glycation, oxidative stress, inflammation, mitochondrial dysfunction, and impaired cellular repair, this disturbance spreads across multiple organ systems.

Consequences extend far beyond diabetes to include cardiovascular disease, hypertension, dyslipidaemia, metabolic dysfunction-associated fatty liver disease, Polycystic Ovarian Disease, erectile dysfunction, stroke, cognitive decline, gout, sleep apnoea, autoimmune conditions, selected cancers, and accelerated ageing.

This perspective challenges a common clinical assumption that controlling blood sugar, cholesterol, and blood pressure is adequate to maintain health. Infact, blood sugar, cholesterol, and blood pressure are often downstream manifestations rather than primary causes of disease. Pharmacological treatment remains essential in many situations, particularly for reducing immediate risk, but long-term disease control requires addressing the metabolic environment that produces these abnormalities.

The economic consequences are equally profound. Obesity-related healthcare expenditure in the United States exceeds USD 170 billion annually, while metabolic syndrome imposes major costs across Europe. For India, where healthcare resources remain

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constrained, prevention through lifestyle intervention is not only medically necessary but economically indispensable.

### Biological Processes Driving Metabolic Disease

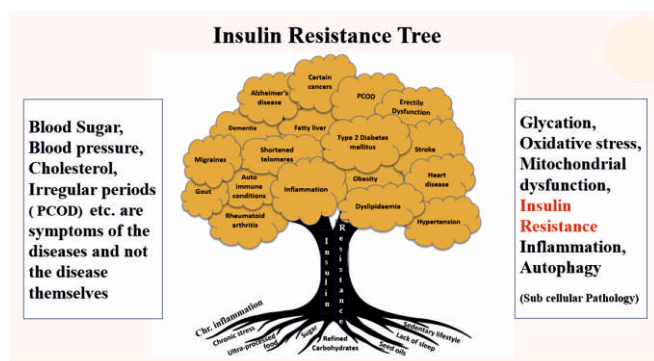
Metabolic dysfunction develops through interconnected biological pathways.

#### Glycation

Persistently elevated glucose binds non-enzymatically to proteins & lipids, generating advanced glycation end-products (AGEs) that impair vascular, neural, renal, and connective tissue function. Glycation begins well before overt diabetes and is strongly influenced by refined carbohydrate intake.<sup>7</sup>

#### Oxidative Stress and Mitochondrial Dysfunction

Excess nutrient exposure increases reactive oxygen species (ROS), damaging DNA, cell membranes, and mitochondria. This activates inflammatory pathways and worsens insulin resistance. Dysfunctional mitochondria reduce fatty acid oxidation and promote intracellular lipid accumulation. Exercise stimulates mitochondrial renewal, explaining why physical activity improves metabolic health even without major weight loss.<sup>8,9</sup>



### Insulin Resistance

The central linking mechanism. When muscle, liver, and adipose tissue become less responsive to insulin, glucose uptake declines and insulin levels rise. The liver overproduces glucose and triglycerides; adipose tissue releases excess free fatty acids; skeletal muscle loses metabolic flexibility.<sup>10</sup> Insulin resistance drives not only diabetes but also hypertension, dyslipidaemia, endothelial dysfunction, and vascular diseases.

### Epigenetic Regulation and Methylation

Diet influences gene expression through epigenetic mechanisms such as DNA methylation. Nutrients including folate, vitamin B12, choline, and betaine alter expression of genes regulating lipid metabolism, inflammation, and mitochondrial function,<sup>11</sup> providing a biological explanation for how dietary habits shape disease risk across generations.

### Chronic Inflammation and Impaired Autophagy

Visceral fat acts as an inflammatory organ, releasing cytokines such as TNF- $\alpha$  and IL-6 while reducing protective adiponectin. This persistent low-grade inflammation worsens insulin signalling and accelerates vascular injury.<sup>12</sup>

At the same time, chronic caloric excess suppresses autophagy—the cellular recycling process responsible for clearing damaged proteins and organelles. Reduced autophagy contributes to ageing, metabolic disease, and neurodegeneration. Intermittent fasting and caloric restriction may partially restore this process.<sup>13</sup>

### Lifestyle Modification: The Most Powerful Therapeutic Tool

Metabolic disease is largely shaped by daily behaviours. The strongest interventions often exist outside conventional pharmacotherapy. The following Lifestyle modification can correct the Metabolic ill health: Diet Modification, Physical Activity, Stress Management, Adequate Sleep, Intermittent Fasting and Avoiding Ultra processed foods.

**1. Diet:** Diet remains the most effective lever for improving insulin sensitivity.

**Control Carbohydrates:** though glucose is the source of energy for all cells, excess carbohydrate is the main cause of hyperinsulinemia. There is nothing called essential carbohydrates unlike Essential Amino Acids and Essential Fatty Acids. Hence restricting carbohydrates to bare minimum is metabolically healthy.<sup>14</sup> Avoid Refined carbohydrates: (packed & Labelled food) . Eat home made food & least processed carbohydrates, from vegetable and fruits (Eating fruits is fine but drinking fruit juice is not metabolically healthy

as it does not contain fiber. Reduce frequency of eating. Two meals per day or maximum three times per day. (Nothing other than water to be taken, between meals)

**Prioritise Proteins:** for healthy Muscle & Bone mass. Focus on Essential Amino Acids from animal source or proper combination of Plant Source Proteins. Pair proteins with polyphenol rich foods for better digestion and absorption of proteins. Plant sources of proteins like nuts, seeds, and legumes have Fiber & Fats along with Protein. As Protein has a high degree of satiety, the frequency of eating will reduce

**Don't fear fats:** In nature good proteins always come with fats. Fats help digest protein better. Omega 3 fatty acids are deficient in our diet where as Omega 6 are in excess. We need to have proportion of Omega3: Omega 6 ideally 1:1 to 1:4. Our current ratio is 1:25 or more. Omega 6 fatty acids are inflammatory. All refined oils also have been subjected to high temperature for extraction and treated with harmful chemicals. Use Ghee/ Cold pressed groundnut oil / cold pressed coconut oil for cooking.<sup>15</sup>

**2. Intermittent Fasting:** Early time-restricted eating & Fasting improve insulin sensitivity.

### **3. Physical Activity:**

Physical activity in general and Resistance Exercise in particular, improve metabolic health through mechanisms extending beyond weight reduction.

Aerobic activity increases skeletal muscle glucose uptake and insulin sensitivity. Resistance training increases metabolically active lean mass. High-intensity interval training (HIIT) provides comparable benefits in less time.

Current WHO recommendations advise 150–300 minutes of moderate aerobic activity weekly with strength training at least twice weekly.<sup>16</sup>

Lifestyle interventions combining diet and exercise significantly improve blood pressure, triglycerides, fasting glucose, and waist circumference and may double rates of metabolic syndrome resolution compared with standard care.<sup>17</sup>

Movement should therefore be viewed as a therapeutic intervention—not merely a weight management strategy.

### **4. Stress Management**

Chronic stress exerts measurable metabolic effects. Sustained cortisol elevation promotes central adiposity, worsens insulin resistance, increases blood pressure, and alters appetite regulation.<sup>18</sup>

Interventions including walking in a garden, deep breathing, Om chanting, Yoga, Mindfulness, relaxation training, and structured stress reduction have demonstrated improvements in glycaemic control and cardiovascular risk markers.

Stress management is not an optional adjunct—it is part of metabolic treatment.

### **5. Sleep and Circadian Alignment:**

Sleep quality and metabolic health are tightly linked.

Insufficient or disrupted sleep increases insulin resistance, alters appetite hormones, elevates cortisol, and promotes weight gain. Circadian disruption caused by irregular schedules, shift work, and late-night light exposure further impairs glucose regulation.<sup>19</sup>

Practical recommendations include maintaining regular sleep timing, aim for 7–9 hours sleep every day, reduce evening screen exposure, align meals and activity with natural day–night rhythms. These are low-cost interventions with substantial metabolic benefits.

### **6. Intermittent Fasting and Time-Restricted Eating:**

Intermittent fasting has emerged as a promising metabolic intervention. Extending fasting periods lowers insulin exposure, promotes fat oxidation, activates Activated Protein Kinase AMPK, suppresses mTOR signalling, and enhances autophagy.<sup>20</sup>

Time-restricted eating protocols have demonstrated improvements in body weight, insulin levels, blood pressure, and inflammatory markers even without intentional calorie restriction.<sup>2</sup> Early daytime eating patterns may offer additional advantages through circadian alignment.

Fasting is not appropriate for everyone and requires caution in pregnancy, type 1 diabetes, and individuals with eating disorders. However, when individualised appropriately, fasting can become a valuable component of metabolic care.

### Conclusion: Reframing the Future of Public Health

Metabolic ill health is the defining epidemic of modern society. The expanding NCD burden reflects not isolated diseases but a shared metabolic disturbance driven by poor diet, inactivity, stress, inadequate sleep, and disrupted eating patterns. Cholesterol, blood sugar, and blood pressure are important indicators—but they are often visible consequences of deeper dysfunction.

Lifestyle interventions act closer to the biological root of disease. They improve insulin sensitivity, reduce inflammation and oxidative stress, restore mitochondrial function, support autophagy, and alter metabolic trajectories at both individual and population levels.

For preventive medicine, the implication is clear: lifestyle modification must become foundational not supplementary to chronic disease prevention and management. The future of public health will depend less on treating metabolic complications and more on creating environments that make metabolic health possible.

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## Morbidity And Out of Pocket Expenditure Among the Households of a Rural area of Kozhikode district, Kerala- A Cross-Sectional Study

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### Abstract:

**Introduction:** Universal Health Coverage ensures access to quality healthcare without financial hardship. Even though Indian state Kerala has good achievements of health indicators, Out of Pocket expenditure remains a major concern. **Objectives:** To assess the prevalence of reported out-patient and in-patient morbidity, healthcare service utilization and to estimate the associated Out of Pocket expenditure. **Methods:** A Community based Cross Sectional study was conducted among 663 households (n=2371) of Chathamangalam Gram Panchayat, Kozhikode district. A multistage random sampling technique was used. Data on Out Patient (OP) and In Patient (IP) morbidity and expenditure, Health Insurance details were collected using a pre tested questionnaire. **Results:** Prevalence of OP and IP morbidity rate was 174 and 19 per 1000 population respectively. Private sector utilization was higher for both OP (53.4%) and IP (77%) care. OOPE for OP care at public and private care was ₹145 and 700 respectively. Highest Expenditure in public care was for medicines (₹500) and in private for investigations (₹1150). IP OOPE for public and private care was 600 and 5050 respectively. Highest Expenditure in public was for medicines (₹500) in private for investigations (₹1250). While 74.6% of households were enrolled in health insurance schemes, insured family incurred a median OOPE of ₹2625 compared to ₹4250 among the uninsured. **Conclusion:** OP and IP health care continue to impose huge financial burden on households in Kerala. Expanding financial protection to cover OP care and improving service delivery in the public sector are essential in achieving UHC.

**Keywords:** Health Expenditure, Health Insurance, Morbidity, Out of Pocket Expenditure, Universal Health Coverage

### Introduction:

The World Health Organization (WHO) defines “Universal Health Coverage” (UHC) as access to essential, quality healthcare services along with financial risk protection, thereby promoting equity and efficiency across healthcare systems globally<sup>[1]</sup>. It is the cornerstone of global health policy, aiming to ensure that all

individuals receive essential health services without suffering financial hardship. In line with this, “Sustainable Development Goal” (SDG) 3.8 calls for achieving UHC by ensuring financial risk protection and equitable access to quality essential healthcare services to which India is a signatory.<sup>[2]</sup>

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In India, a substantial proportion of the population continues to face financial hardship in accessing healthcare, as reflected in the high reliance on out of pocket expenditure as reported in the National Sample Survey Organisation's (NSSO) 75th round (2017–2018).<sup>[3]</sup> The NITI Aayog has emphasized the UHC vision through various health system reforms focusing on expanding financial protection, strengthening primary healthcare, and reducing out-of-pocket expenditure.<sup>[4]</sup> These include Public Funded Health Insurance (PFHI) schemes such as Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (PMJAY) which was introduced in 2018, along with other state sponsored schemes aimed at reducing catastrophic health expenditures (CHE).<sup>[5]</sup>

Kerala, one of the Indian states widely acclaimed for its outstanding public health achievements, continues to lead in NITI Aayog's Health Index among large states, owing to its low maternal and infant mortality, high literacy and life expectancy comparable to that of developed nations.<sup>[4]</sup> Despite better access to healthcare services, a high proportion of households in Kerala continue to rely on out-of-pocket expenditure (OOPE) to meet healthcare needs. NSSO estimates suggest that 84% in rural areas and 80% of urban households depend on OOPE to meet hospitalisation costs.<sup>[6]</sup> Rural households primarily depended on their household income or savings (80%) and borrowings (13%) to meet health expenditures. This finding suggests that despite strong health indicators and long-standing investments in public health, financial protection remains limited in the state. This persistent burden can be attributed to factors like cultural inflation of morbidity, the growing privatization of health services, rising drug prices, commercialization of care, and overuse of diagnostic technologies.<sup>[6]</sup>

Despite the state's well-recognized achievements in public health and sustained investments in healthcare infrastructure, there exists a critical gap in latest household-level evidence of morbidity patterns, healthcare utilization and OOPE in Kerala following introduction of Public Funded Health Insurances (PFHI)

schemes. Such evidence is essential to identify healthcare access gaps and thus to improve financial protection mechanisms, thereby advancing UHC in both policy and practice. Therefore, the objectives of the study were to assess the prevalence of self-reported OP and IP morbidity, healthcare service utilization, estimate the associated OOPE and compare financial burden among households according to the status of any health insurance (HI) status.

### Method:

A household level cross-sectional study was conducted in a rural area of Kozhikode district, Kerala, during January 2024 to December 2024. A multistage sampling technique was employed to select the study area and participants. In the first stage, one GP was selected from the 70 GPs in Kozhikode district using simple random sampling. The selection of a single Gram Panchayat was based on feasibility and the need for intensive household level data collection. The selected GP was Chathamangalam, which comprises 23 wards with a population of 46,000, and it has one Primary Health Centre (PHC) with six sub-centres and three private clinics.<sup>[7]</sup> The availability of both public and private healthcare facilities was within accessible distance to the selected wards.

Sample size was calculated based on a morbidity prevalence of 42% from a previous study,<sup>[8]</sup> with a 5% allowable error and 95% confidence level. A design effect of 1.95 was applied to account for clustering at the ward level. In the absence of prior local estimates of intra-cluster correlation, a value close to 2 was assumed, which is commonly used in community-based multistage sampling studies. The final sample size was rounded to 700. From the list of households obtained from the GP, 175 households were selected from each of the four selected wards using systematic sampling.

To select households, a random starting direction from the center of the ward was chosen by spinning a pen. And households along that direction were selected sequentially until the required number of houses from each ward was obtained. Permanent residents of the

households who had been residing for at least the past six months and were willing to participate were included in the study. Households unavailable even after two follow up visits, were excluded. House to house surveys were conducted by trained investigators using a pre-tested semi-structured questionnaire. After obtaining Informed consent, data were collected from the head of the household or a responsible adult including socio-demographic and enrolment in any HI, self-reported morbidity and health expenditure details of each household members.

OP Morbidity data were collected for a recall period of 15 days and IP morbidity data were collected for a recall for a period of 365 days. Morbidity was classified independent of healthcare utilization. OP morbidity included all self-reported illness episodes within the recall period, irrespective of whether care was sought, including self-medication and unmet need, while IP morbidity included episodes requiring hospital admission. Self-medication episodes were categorized as non-institutional care and were excluded from analysis of healthcare facility utilization. Multiple morbidity episodes reported by the same individual within the recall period were recorded and analyzed as separate episodes. Additional information included system of medicine utilized (Allopathy, Ayurveda, Homeopathy and Selfcare) and the type of healthcare facility used (public or private). Wherever available, data were verified by cross checking medical records, prescriptions and bills. In cases where records were not available, expenditure details were based on participant recall. Child birth related data were excluded as they represent planned healthcare utilization with distinct financing mechanisms, which could disproportionately influence OOPE estimates. Ethical clearance was obtained from the Institutional Ethics Committee and permission was secured from the local self-government authority.

Collected data were cross checked for completion and consistency to ensure reliability. and were entered in Microsoft Excel and analyzed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY,

USA). Descriptive statistics were used to estimate prevalence of morbidity and summarize expenditure patterns. Prevalence of Morbidities were expressed per 1000 population (OP 15-day recall period, IP 1 year recall period). OOPE was calculated by summing the costs for doctor consultation, medicines, diagnostic or laboratory tests, and transportation, expressed in Indian Rupees (INR) and was summarized using the median and interquartile range (IQR). NCD related OP morbidity episodes were excluded from OOPE estimation due to their recurrent nature and potential to overestimate short term expenditure within the recall period.

### **Results:**

A cross-sectional study was conducted among 700 households. Of these, 663 households (94.7%) comprising 2371 individuals participated in the study and were included in the final analysis. A total of 37 households were excluded, of which 12 households did not provide consent, 9 had incomplete data, and 16 were unavailable despite two follow up visits. The mean age of the study population was  $32 \pm 20$  years (mean  $\pm$  SD) with a slight female predominance (51.4%).

#### **Out-Patient Care**

Out of the total population, 413 OP morbidities were reported over 15 days recall period, corresponding to a rate of 174 per 1000 population. Multiple morbidity episodes reported by the same individual within the recall period were counted separately. Most frequently reported cause of OP morbidities were infectious diseases (76.9%) which included viral fever, respiratory tract infections (RTI), mumps, chickenpox, viral hepatitis, etc. Accidents and Injuries were constituted 7.6%. (Table 1) Of the total 413 OP morbidity episodes, 343 (83.1%) sought care from any health facilities, while 70 (16.9%) were managed through self-medication. Modern medicine was the most commonly utilized system (99.03%). Among those who sought care from a healthcare facility, 183 (53.4%) episodes were managed in private facilities, while 160 (46.6%) were managed in public facilities.

**Table 1- Distribution of Self-reported Out Patient morbidities by type (15-day recall period)**

| Morbidities          | Frequency | Proportion | Per 1000 population |
|----------------------|-----------|------------|---------------------|
| Infectious Diseases* | 318       | 76.9       | 134.1               |
| Accidents & Injury   | 31        | 7.6        | 13.07               |
| Others#              | 64        | 15.5       | 26.9                |
| Total                | 413       | 100        | 174                 |

\* Also included Mumps (n=15), Chickenpox (n=7), Hepatitis A (n=26).

# Skin allergies, Gastritis, Dental problems, gynaecological problems

**Table 2 – Median OOPE for outpatient care in public and private facilities (in INR)**

| Component      | Private OP (INR)   |                                                     | Public OP (INR)    |                                                     |
|----------------|--------------------|-----------------------------------------------------|--------------------|-----------------------------------------------------|
|                | Median expenditure | IQR (25 <sup>th</sup> –75 <sup>th</sup> percentile) | Median expenditure | IQR (25 <sup>th</sup> –75 <sup>th</sup> percentile) |
| Transportation | 125                | 83.75-212.50                                        | 100                | 100-250                                             |
| Consultation   | 200                | 113.75-512.50                                       | 100                | 150-300                                             |
| Lab            | 1150               | 130-4482.50                                         | 300                | 200-800                                             |
| Medicines      | 555                | 475-2600                                            | 500                | 300-2500                                            |
| OOPE           | 700                | 450–1340                                            | 145                | 55–455                                              |

**Table 3- Distribution of inpatient morbidities by type (1 year recall period)**

| Morbidities         | Frequency | Proportion | Per 1000 population |
|---------------------|-----------|------------|---------------------|
| NCDs                | 19        | 43.1       | 8.1                 |
| Infectious Diseases | 15        | 34.2       | 6.3                 |
| Surgeries*          | 7         | 15.9       | 2.9                 |
| Accidents & Injury  | 3         | 6.8        | 1.2                 |
| Total               | 44        | 100        | 19                  |

\* Included Hernioplasty, Thyroidectomy, Cataract surgery

**Table 4 - Median OOPE for inpatient care in public and private facilities (in INR)**

| Component      | Private IP(INR)    |                                                     | Public IP(INR)     |                                                     |
|----------------|--------------------|-----------------------------------------------------|--------------------|-----------------------------------------------------|
|                | Median expenditure | IQR (25 <sup>th</sup> –75 <sup>th</sup> percentile) | Median expenditure | IQR (25 <sup>th</sup> –75 <sup>th</sup> percentile) |
| Transportation | 500                | 400 – 5000                                          | 300                | 150 – 850                                           |
| Consultation   | 300                | 300 – 475                                           | 200                | 10 – 550                                            |
| Lab            | 1250               | 200 - 3250                                          | 300                | 500 – 1500                                          |
| Medicines      | 1000               | 575 - 4000                                          | 500                | 300 – 2500                                          |
| OOPE           | 5050               | 1510 - 13800                                        | 600                | 350 – 4200                                          |

Median OOPE for OP care was 145 (IQR: 55–455) in public facilities and 700 (IQR: 450–1340) in public and private facilities respectively. In public facilities, the cost of medicines (500) accounted for the highest share and in private facilities, it was for investigations (1150). (Table 2)

#### Inpatient Care

Over a one-year recall period, 44 IP morbidity incidents were reported with an incident rate of 19 per 1000 population. Of this, 77% were admitted in private facilities and only 23% were in public facilities. Cause of hospitalization in 43.1% were NCDs and 34.4% were infectious diseases. (Table 3)

Total OOPE for IP care was 600 (IQR 350 - 4200) and 5050 (IQR 1510- 13800) in public and private facilities respectively. In public facilities, cost of medicines (500) accounted for the highest share and in private facilities, it was for investigations (1250). (Table 4) Most of the surgeries were treated in private facilities and were not covered under any HI.

#### INSURANCE COVERAGE

Out of 663 households, 494 households (74.6%) were enrolled in some form of health insurance (HI) scheme, while 169 households (25.4%) had no HI coverage. The most commonly availed scheme was Pradhan Mantri Jan Arogya Yojana (PMJAY), a centrally sponsored scheme providing financial protection for secondary and tertiary inpatient care to economically vulnerable families, covering 298 households (44.9%). This was followed by Karunya Arogya Suraksha Padhathi (KASP), Kerala's state-integrated scheme extending PMJAY coverage for eligible beneficiaries, availed by 140 households (21.3%). Medical Insurance Scheme for State Employees and Pensioners (MEDISEP), a contributory insurance scheme for government employees and pensioners, covered 45 households (6.8%). Ex-Servicemen Contributory Health Scheme (ECHS), which provides healthcare services to ex-servicemen and their dependents, covered 2 households (0.3%), while Central Government Health Scheme (CGHS), meant for central government employees and pensioners, covered 1 household (0.1%). Private insurance coverage (Star Care) was reported by 8 households (1.2%). Participants who availed insurance had a median OOPE of 2625 for inpatient care compared to 4250 among uninsured households.

#### Discussion:

This cross-sectional study was conducted with objective to assess the prevalence of OP and IP morbidities and to estimate the associated OOPE with type of health care in a rural community

#### Out Patient Care

The present study reported a lower prevalence of OP morbidity compared to 245 per 1000 reported for

Kerala in the NSSO<sup>[3]</sup>. This difference may be due to variations in study setting and sampling, including possible selection bias, as well as differences in health-seeking behaviour. It may also reflect underreporting or delayed care-seeking due to competing household priorities. In this study, 16.9% of morbidity episodes were managed through self-medication, which is higher than previously reported (<5%).<sup>[3]</sup> Previous studies have also suggested that such practices may be influenced by economic constraints and increasing access to health information through informal sources.<sup>[9,10]</sup>

In this study, similar to the findings reported from other Indian states, infectious diseases accounted for nearly three fourth of OP morbidities, with the most prevalent conditions being fever and RTI.<sup>[8]</sup> In the year 2024 in which the study was conducted, there was an increased incidence of mumps in the area, reflecting a broader outbreak reported across the state, as evidenced by the Kerala State Surveillance Unit under Integrated Disease Surveillance Program (IDSP), which recorded 70,402 mumps cases state-wide in 2024.<sup>[11]</sup> Similarly, this year also experienced a Hepatitis A outbreak in this area, similar to other districts, with 7423 reported cases at the state level.<sup>[12]</sup> Public health experts described it as the “developmental paradox”, where the state is in the late epidemiological transition stage. This was followed by accidents and injuries, and other conditions like skin allergies, dental, and gynaecological problems (Table 1). The high prevalence of accidents is attributed to road traffic accidents with the increasing number of motor vehicles in the state 350/1000 population. The observed proportion of accidents and injuries in this study may be partly related to road traffic incidents; however, given the small number of cases and the localized study setting, these findings may not be directly comparable with state level estimates.

In the present study, more than half of OP care was sought from private facilities. This pattern is similar to the previous reported study done by Alayed A et al.<sup>[6]</sup> In the study setting, both public and private healthcare facilities were accessible to the selected wards, allowing

individuals to choose between providers. The preference for private facilities observed in this study may reflect perceived advantages such as shorter waiting times and convenience.

#### Outpatient Care Expenditure

In this study, total OOPE for OP care was 422.5 with 145 in public facilities and 700 in private facilities respectively. Investigations (1150) were the major contributors to OOPE in private facilities compared to public facilities (lab: 300; medicines: 500), this could be due to over investigating for minor illness without indications. Whereas in public facilities major OOPE contribution was from medicine (500). This may be due to doctors prescribing medicines which were not available at public facilities and the limited availability of essential drugs in the public sector, leading patients to rely on other external sources<sup>[20]</sup>

The higher out-of-pocket expenditure (OOPE) in private facilities was mainly driven by investigation costs, while in public facilities, medicines constituted the major share. This may be partly due to non-availability of certain drugs in public facilities, requiring out-of-pocket purchase. Broader factors such as drug pricing policies (DPCO 2013) and supply issues in systems like KMSCL have been reported in the literature, though not directly assessed in the study<sup>[13]</sup>

Concerns regarding prescription practices, including inappropriate drug combinations and antibiotic use, as well as lack of standard treatment protocols and regulatory variations, have also been documented<sup>[14–16]</sup> The OOPE estimated reflects direct medical expenditure during the 15-day recall period and does not capture the cumulative burden of recurrent morbidity.

#### Inpatient Care

The present study showed a hospitalisation rate of 19 per 1000 persons per year, which is lower than estimates reported by NSSO for India (29 per 1000) and Kerala (105 per 1000).<sup>[3]</sup> The lower rate observed may also be influenced by factors such as underreporting or

limited external validity. We presume that the lower hospitalisation rate seen in the present study may not necessarily indicate a true reduction in morbidity and could be influenced by methodological and contextual factors. From an economic perspective, healthcare utilisation is known to be influenced by affordability and cost-related barriers, where individuals may delay or avoid seeking care due to financial constraints. This concept is well described in health economics literature; however, it was not directly assessed in the present study.

In our study, among the reported inpatient episodes, NCDs (43.1%) and infectious diseases (34.2%) constituted the major categories. These proportions reflect the distribution of causes among hospitalised cases in the study population and should not be interpreted as representing the overall disease burden.

Here more than three fourth of hospitalisations were in private hospitals. The higher utilisation of private IP services similar to OP may attribute to the growing trend of privatisation of health care in the state. This preference for private hospitals may be influenced by factors such as perceived accessibility, availability of services, and empanelment of private hospitals under PFHI schemes; Similar diversion of healthcare utilisation towards private facilities under existing HI schemes was reported in a study conducted by Smith KT et al.<sup>[17]</sup> Another reason was according to their perceived aspirations people might also perceive better quality, quicker admission, and more personalised care in private settings, may influence this trend.

#### Inpatient Care Expenditure

The median OOPE for IP care in this study was higher in private hospitals (5050; IQR 1510–13800) compared to public facilities (600; IQR 350 – 4200), with high expenditure for laboratory investigations in private (1250; IQR 200–3250) and for medicines in public facilities (1000; IQR 575 – 4000), which was similar to OP care. These results are consistent with the NSSO data for Kerala, which reported a much higher average IP expenditure of 25,949 in private hospitals and 4,395 in public hospitals. The OOPE in public health

facilities are of concern, because government spends a huge amount for human, material resources at the expense of taxpayers.<sup>[18]</sup> As per the National Health Accounts (NHA), the per capita public health expenditure in India is 2,590, accounting for only 24.4% of the total health expenditure; in Kerala it is 4338 which is 32.5% of total.<sup>[19]</sup> Despite this, patients may still incur OOPE due to factors such as medicine unavailability, outsourcing of diagnostic services, and referrals to private pharmacies or laboratories, many of which function on a profit based model.

OOPE for IP care in the private sector was 5050 (1510–13800), possibly because patients were admitted for minor illnesses or discharged within a day to comply with insurance claim requirements. The maximum expenditure reported from public sector was 12,205 and from private sector was 51,500, and Variations in expenditure estimates may be influenced by differences in study setting, sample characteristics, and the number of hospitalization events captured in the present study.

In public hospitals, the major share of expenditure was on medicines (500; 300–2500), similar to the pattern observed for outpatient care, as explained in the section above. Despite the nominal availability of free care in government hospitals, hidden costs such as diagnostics and drug purchases contribute to the financial burden. These findings are similar to previous studies which indicate that even public sector services are not entirely free of cost.<sup>[20]</sup>

#### Health Insurance Coverage

Present study revealed that nearly three-fourths of households were covered under some form of HI schemes, many of which primarily target economically vulnerable populations and predominantly cover inpatient services. The OOPE for IP care was 2625 among the insured, compared to 4250 among the uninsured which showed that HI schemes have some protection. Although the OOPE was relatively lower for the insured who belongs to BPL category, they still incurred substantial OOPE, indicating that they also suffer high financial burden and are not fully protected.

In the present study, households enrolled in health insurance schemes incurred relatively lower OOPE for inpatient care compared to the uninsured; however, a substantial financial burden still persisted, indicating only partial financial protection. The findings also showed that outpatient care contributed considerably to household expenditure despite high insurance enrolment, as most schemes primarily covered inpatient services.<sup>[3,24]</sup>

As seen in our study, OP care, which constitutes a major portion of health spending, remains excluded from health insurance coverage. Without financial protection for OP services, the burden of OOPE is likely to persist, especially for low-income households.

Since OP expenditure may occur repeatedly throughout the year, the annual OP expenditure could be substantially higher than IP expenditure. If 15-day OP morbidity rate of 145 per 1000 is extrapolated over 24 recall period, the annual burden becomes 10,152 ( $423 \times 24$ ), which exceeds IP expenditure associated with a rate of 19 per 1000.

**Conclusion:** The present study found that the prevalence of outpatient (OP) and inpatient (IP) morbidity was 174 and 19 per 1000 population, respectively. Utilization of private healthcare facilities was higher for both OP and IP care. Out-of-pocket expenditure (OOPE) was higher in private facilities compared to public facilities for both OP and IP services. A substantial proportion of households were covered under health insurance; however, OOPE remained considerable among both insured and uninsured households.

**Limitations:** Since data on OP and IP care were collected retrospectively, there is a possibility of recall and information bias, particularly for minor ailments and undocumented expenditures. The study relied on self-reported morbidity and expenditure data, which may be subject to reporting bias despite efforts at verification. The use of different recall periods for OP (15 days) and IP (1 year) morbidity may also influence comparability. Exclusion of NCD related OP morbidity and childbirth-related expenditure may have led to underestimation of

overall OOPE. As the study was conducted in a single Gram Panchayat, the findings have limited generalizability and may not represent the entire district or state. Additionally, the cross-sectional design limits causal interpretation of the observed associations

### Recommendation:

PFHI policies should be broadened to include OP care expenditure also. Based on the findings of this study, there is a need to explore strategies to reduce OOPE, particularly for outpatient care, including consideration of expanding financial protection mechanisms such as insurance coverage for OP services, along with strengthening service availability in public healthcare facilities.

### Declaration:

**Conflict of Interest:** None declared

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## Prevalence and Determinants of Hypertension among Tribal Adults in Sambalpur, Odisha: A Cross-Sectional Study

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### Abstract:

**Introduction:** Hypertension is a major non-communicable disease and a leading contributor to cardiovascular morbidity and mortality worldwide. Tribal populations in India, despite their distinct socio-cultural characteristics, are increasingly exposed to lifestyle transitions that may increase their risk of hypertension. However, there is limited evidence on the prevalence and determinants of hypertension among tribal communities in Odisha.

**Objectives:** To estimate the prevalence of hypertension and identify associated risk factors among the adult tribal population of Sambalpur district, Odisha. **Methods:** A community-based cross-sectional study was conducted among 360 adult tribal individuals aged 18–60 years in Sambalpur district. Participants were selected using a multistage sampling technique. Data were collected through face-to-face interviews using a pretested structured questionnaire, and Blood pressure was measured using standard WHO protocol, and the average of three readings was taken for analysis as per JNC-8 recommendations. Data were analysed using descriptive statistics, chi-square test, and logistic regression to identify factors associated with hypertension. **Results:** The mean age of participants was  $41.5 \pm 11.6$  years, and males constituted 54.4% of the study population. The overall prevalence of hypertension was 13.6%. Among hypertensive individuals, 40.8% were newly diagnosed during the survey. Only 20.6% of known hypertensive cases had their blood pressure under control. Multivariable logistic regression showed that age 41–60 years (AOR = 2.578;  $p = 0.016$ ), family history of hypertension (AOR = 4.288;  $p < 0.001$ ), and alcohol consumption (AOR = 2.825;  $p = 0.010$ ) were significant predictors. **Conclusion:** Hypertension is prevalent among the tribal population of Sambalpur. Strengthening early detection, lifestyle modification, and primary healthcare services is essential to address this public health concern.

**Keywords:** Alcohol Drinking, Hypertension, Odisha, Risk Factors, Tribal Population.

### Introduction:

Hypertension is one of the most important preventable causes of premature morbidity and mortality

worldwide. According to the World Health Organization (WHO), approximately 1.28 billion adults globally live with hypertension, with nearly 2/3rd residing in low- and

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middle-income countries.<sup>[1]</sup> It is a major risk factor for cardiovascular diseases (CVDs) such as coronary heart disease, stroke, heart failure, and chronic kidney disease, contributing to more than 10 million deaths each year.<sup>[2]</sup>

In India, the burden of non-communicable diseases (NCDs) has been rising steadily due to rapid urbanization, demographic transition, and lifestyle changes. Estimates from the Global Burden of Disease (GBD) study indicate that hypertension accounts for about 8.5% of the total disability-adjusted life years (DALYs) in India.<sup>[3]</sup> The prevalence of hypertension has increased from 19% to 24% among men and from 17% to 21% among women aged over 15 years.<sup>[4,5]</sup> Overall, NCDs account for nearly 53% of total deaths in the country, with hypertension being one of the leading contributors.<sup>[6]</sup> Recognizing the growing burden, the Government of India has prioritized hypertension under the National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD).<sup>[7]</sup>

The state of Odisha, located in eastern India, reflects a similar trend. According to NP-NCD Odisha data (2022), hypertension is a major contributor to the NCD burden in the state, accounting for more than half of the disability-adjusted life years and a substantial proportion of premature deaths.<sup>[8]</sup> Limited access to healthcare services, poverty, and lack of awareness further aggravate the problem, particularly among marginalized populations.

Odisha has a large tribal population, accounting for nearly 22% of the state's population compared to 8.6% nationally as per the 2011 Census.<sup>[9]</sup> Tribal communities often face several barriers to healthcare access, including geographic isolation, lower literacy levels, reliance on traditional healing practices, and inadequate health infrastructure, which may lead to delayed diagnosis and poor control of hypertension.<sup>[10]</sup> Tribal health research has focused mainly on malnutrition and communicable diseases. However, India is currently undergoing an epidemiological transition, with non-communicable diseases increasingly affecting even remote tribal populations.<sup>[11]</sup> Factors such as changing life styles and

socio-economic transitions have contributed to the rising prevalence of hypertension among these communities.<sup>[12]</sup> Community-based studies have reported hypertension prevalence among tribal adults ranging from 15% to 20%, often accompanied by low awareness and poor treatment adherence.<sup>[13,14]</sup>

Sambalpur district in western Odisha is home to several tribal communities with distinct socio-cultural and economic characteristics that may influence the distribution and determinants of hypertension. Despite the implementation of NP-NCD programs at the state and national levels, district-specific data on hypertension among tribal populations in Sambalpur remain limited. Therefore, the present study was undertaken to estimate the prevalence of hypertension and identify associated risk factors among the adult tribal population of Sambalpur district, Odisha.

## Methods:

### Study Design and Setting:

A community-based cross-sectional study was conducted among the tribal population of Sambalpur district, Odisha. The study was designed and planned in the Department of Community Medicine, Veer Surendra Sai Institute of Medical Science & Research (VIMSAR), Burla, Sambalpur. The overall thesis work period was from May 2023 to May 2025; however, the actual data collection was carried out from November 2024 to January 2025. The eligibility criteria for the study included all individuals belonging to the tribal population, aged between 18 to 60 years, who had given their consent to participate. The study excluded individuals who were bedridden or pregnant at the time of data collection.

### Sample size estimation:

Sample size was estimated using the formula

$$n = \frac{Z_{1-\alpha/2}^2 P(1-P) DEFF}{d^2}$$

Where, n = sample size, p = prevalence of hypertension d = allowable error, 5%

$Z_{1-\alpha/2}^2$  = standard normal variate ( $p < 0.05$ ) = 1.96,  $p = 17\%$ , based on previous study.<sup>[15]</sup> DEFF = design effect (1.5), Allowing for a 10% non-response rate, the final sample size was calculated to be 357, H" 360.

### **Sampling Methods:**

Participants were selected using a multistage sampling method conducted in a tribal block of Sambalpur district. Sambalpur district comprises three tribal blocks: Jamankira, Kuchinda, and Bamra. Among these, Jamankira was selected through a lottery method. Within Jamankira, there are 27 subcenters, out of which 9 subcenters were selected using simple random sampling with the help of a random table. From each of these 9 subcenters, 4 villages were selected using the same simple random sampling method. This process resulted in a total of 36 villages. Finally, 10 participants were selected from each of these 36 villages, making the total number of study participants 360. The 1<sup>st</sup> house was selected randomly in each village considering an important landmark of that particular village, then houses were visited consecutively till 10 interviews of tribal participants were completed and the responses were noted. The selected participant not fulfilling the study criteria, Exclusion criteria are not giving consent to participate in study. Data was collected till sample size was achieved.

### **Study Tools and Variables:**

The study utilized a predesigned and pretested structured questionnaire along with instruments such as a calibrated weighing machine, a stretchable measuring tape, and a mercury sphygmomanometer with a stethoscope for anthropometric and blood pressure measurements. The dependent variable of the study was hypertension, which was defined according to the Eighth Joint National Committee (JNC-8) criteria as systolic blood pressure (SBP)  $\geq 140$  mm Hg and/or diastolic blood pressure (DBP)  $\geq 90$  mm Hg.<sup>[16]</sup> The independent variables included various sociodemographic and behavioural factors. Age of participants was recorded in completed years and categorized into 18–40 and 41–60 years. Gender included male, female. Type of family was classified as nuclear (a married couple with dependent

children) or joint (extended family living together with blood relations among males and their spouses or female kin). Educational status was assessed as per the Modified Kuppaswamy scale (2024). Occupation was classified according to the National Classification of Occupations–2015. Socioeconomic status was also assessed using the Modified Kuppaswamy scale updated for 2024. Tobacco use(yes/no), Alcohol consumption, salt intake ( $\geq 5$  grams/day), and physical activity (vigorous, moderate, or mild based on intensity and duration) were also assessed. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared ( $\text{kg}/\text{m}^2$ ) and categorized as per WHO Asian cut-offs: underweight ( $< 18.5 \text{ kg}/\text{m}^2$ ), normal ( $18.5\text{--}22.9 \text{ kg}/\text{m}^2$ ), overweight ( $23.0\text{--}24.9 \text{ kg}/\text{m}^2$ ), and obese ( $\geq 25 \text{ kg}/\text{m}^2$ ). Family history of hypertension and current or past diagnosis of hypertension were also recorded as binary variables (yes/no).

### **Data Sources and data collection methods:**

Ethical approval was obtained from the Institutional Ethical Committee of Veer Surendra Sai Institute of Medical Sciences and Research (VIMSAR), Burla (VIREC). The objectives of the study were explained to the participants and informed consent was obtained prior to data collection. A face-to-face interview was conducted to collect information on socio-demographic, behavioural, and clinical characteristics. Anthropometric measurements including height and weight were recorded using a measuring tape and a calibrated weighing machine, respectively. Height was measured with participants standing erect, barefoot, against a wall with the occiput, back, buttocks, and heels touching the wall, and weight was measured with participants barefoot and standing upright on a calibrated scale; for both measurements, three readings were taken and the average was used for analysis. Participants were made to sit in a relaxed position for at least 5 minutes before blood pressure (BP) measurement. BP was measured using a mercury sphygmomanometer placed at heart level, with the mercury column at the observer's eye level to avoid reading errors. The cuff of appropriate size was placed 2–3 cm above the antecubital fossa with

the cuff bladder covering at least 80% of the arm and centred over the brachial artery, after removing restrictive clothing. BP was first recorded by the palpatory method followed by the auscultatory method. Three readings were taken at 1–2 minute intervals, and the average of the three readings was considered as the final blood pressure value. Systolic blood pressure was recorded at the appearance of the first Korotkoff sound and diastolic blood pressure at the disappearance of Korotkoff sounds, with a deflation rate of 2–3 mm Hg per second.

#### **Data Handling and Management:**

SPSS software version 21.0 was used for data analysis. Data entry was done regularly following data collection, after coding the different variables into relevant categories. Data cleaning was also performed by removing or modifying data that were incorrect, incomplete, improperly coded, or duplicated.

#### **Data Analysis:**

A descriptive analysis was done based on frequency distribution of socio-demographic characteristics. Mean and standard deviation of selected study variables were obtained. Crude Odds Ratio (OR), Chi-square test for categorical variables (nominal data) at 95% confidence interval (CI) and alpha level of significance set at 0.05 were used as measures of association in the analysis of factors associated with Hypertension. An odds ratio of  $<1$  was considered protective, while odds ratio of  $>1$  was considered a risk factor. An odds ratio equal to 1 indicated that there was no difference. Confidence interval was used to assess variability of the odds ratio. Risk factors with  $p < 0.05$  were considered as having significant association with hypertension. P-values up to 0.1 in the chi-square test were analysed with univariate analysis. Final analysis was done using multivariable logistic regression for those factors with  $p$  value  $< 0.1$  in univariate logistic regression and using the enter method to arrive at factors that were independent predictors of hypertension. The final model contained only statistically significant factors after adjusting for confounding.

#### **Results:**

A total of 360 tribal participants were interviewed for the study. 196 (54.4%) were males. The average age of the participants was  $41.52 \pm 11.60$  years. The mean age for males and females was  $41.43 \pm 11.65$  years, and  $41.63 \pm 11.58$  years respectively. Most participants (318, 88.3%) were Hindus. 53.3% families were nuclear type. In terms of education, 191 (53.1%) of the respondents had completed primary school. Elementary occupations were reported by 113 (31.4%) of the study participants. According to Socioeconomic Scale, the majority belonged to the upper-lower class (190, 52.8%), followed by the lower class (145, 40.3%). A family history of hypertension was reported by 68 (18.9%) of the participants. Out of the total 360 study participants, 156 (43.3%) consume alcohol. Tobacco use was reported by 274 (76.1%) participants. A majority of the study population (95%) consumed extra salt (more than 5 grams per day) in their diet. Based on the level of physical activity, 154 (42.8%) fell into the Vigorous category. More than half of the participants (57%) had a Body Mass Index (BMI) within the normal range.

Figure 1 shows that “Out of the 49 individuals with hypertension, 40.8% were previously unaware of their condition, while 59.2% had already been diagnosed.

Table 2 shows that on chi-square analysis, age group, family history of hypertension, alcohol intake, and tobacco use were significantly associated with hypertension ( $P < 0.05$ ).

The multivariable logistic regression analysis (Table 3) shows the independent risk factors associated with hypertension, adjusting for potential confounding variables. The individuals aged between 41 and 60 years had significantly higher odds of developing hypertension (Adjusted Odds Ratio [AOR] = 2.578; 95% CI: 1.189–5.587;  $p = 0.016$ ) compared to other age groups (18–40). A family history of hypertension was also found to be a strong determinant, nearly four times the odds of developing hypertension (AOR = 4.288; 95% CI: 1.941–9.472;  $p < 0.001$ ). Alcohol consumption was another significant factor; individuals who consumed

**Table 1: Socio-Demographic Characteristics and Lifestyle Factors of Study Participants (n=360).**

| Factors                        | Sub groups                             | Number (%) |
|--------------------------------|----------------------------------------|------------|
| Age (in years)                 | 18-40                                  | 156 (43.3) |
|                                | 41-60                                  | 204 (56.7) |
| Gender                         | Male                                   | 196 (54.4) |
|                                | Female                                 | 164 (45.6) |
| Religion                       | Hindu                                  | 318 (88.3) |
|                                | Other                                  | 42 (11.7)  |
| Type of family                 | Nuclear                                | 192 (53.3) |
|                                | Joint                                  | 168 (46.7) |
| Education                      | Illiterate                             | 56 (15.6)  |
|                                | Primary school certificate             | 191 (53.1) |
|                                | Middle school certificate              | 33 (9.20)  |
|                                | High sc.& above                        | 80 (22.2)  |
| Occupation                     | Clerks                                 | 11 (3.06)  |
|                                | Skilled workers & shop sales worker    | 36 (10)    |
|                                | Skilled agricultural & fishery workers | 82 (22.7)  |
|                                | Plant & machine operator               | 40 (11.1)  |
|                                | Elementary occupation                  | 113 (31.4) |
|                                | Unemployed                             | 78 (21.7)  |
| Socio-economic status          | Lower middle                           | 25 (7.00)  |
|                                | Upper lower                            | 190 (52.8) |
|                                | Lower                                  | 145 (40.3) |
| Family history of Hypertension | Present                                | 68 (18.9)  |
|                                | Absent                                 | 292 (81.1) |
| Alcohol consumption            | No                                     | 204 (56.7) |
|                                | Yes                                    | 156 (43.3) |
| Tobacco use                    | No                                     | 86 (23.9)  |
|                                | Yes                                    | 274 (76.1) |
| Extra salt intake              | No                                     | 18 (5.0)   |
|                                | Yes                                    | 342 (95.0) |
| Physical activity              | Mild                                   | 88 (24.4)  |
|                                | Moderate                               | 118 (32.8) |
|                                | Vigorous                               | 154 (42.8) |
| Body mass index (B.M.I)        | Underweight                            | 53 (14.7)  |
|                                | Normal                                 | 206 (57.2) |
|                                | Overweight                             | 56 (15.6)  |
|                                | Obese                                  | 45 (12.5)  |

\*High sc. Stands for High school.

**Figure 1: Hypertension Awareness and Control Among Hypertensives.**

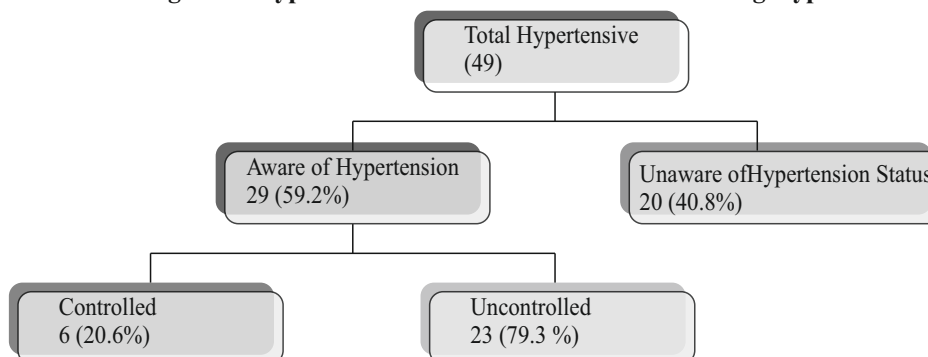


Table 2: Association between Socio-Demographic and Lifestyle Factors with Hypertension (n=360).

| Variables               | Sub groups              | Hypertension   |                | $\chi^2$ | p     |
|-------------------------|-------------------------|----------------|----------------|----------|-------|
|                         |                         | No (%) (n=311) | Yes (%) (n=49) |          |       |
| Age (in years)          | 18-40                   | 144 (92.3)     | 12 (7.7)       | 8.202    | 0.004 |
|                         | 41-60                   | 167 (81.9)     | 37 (18.1)      |          |       |
| Gender                  | Male                    | 168 (85.7)     | 28 (14.3)      | 0.167    | 0.683 |
|                         | Female                  | 143 (87.2)     | 21 (12.8)      |          |       |
| Religion                | Hindu                   | 273 (85.5)     | 45 (14.2)      | 0.676    | 0.411 |
|                         | Other                   | 38 (90.5)      | 4 (9.5)        |          |       |
| Education               | Illiterate              | 46 (82.1)      | 10 (17.9)      | 3.863    | 0.277 |
|                         | Primary                 | 162 (84.8)     | 29 (15.2)      |          |       |
|                         | Secondary               | 29 (87.8)      | 4 (12.1)       |          |       |
|                         | High sc. & above        | 74 (92.5)      | 6 (7.5)        |          |       |
| Occupation              | Clerk                   | 9 (81.8)       | 2 (18.2)       | 10.691   | 0.058 |
|                         | Skilled worker          | 32 (88.9)      | 4 (11.1)       |          |       |
|                         | Sk. Agricultural worker | 71 (86.6)      | 11 (13.4)      |          |       |
|                         | Machine operator        | 37 (92.5)      | 3 (7.5)        |          |       |
|                         | Elementary occupation   | 89 (78.8)      | 24 (21.2)      |          |       |
|                         | Unemployed              | 73 (93.6)      | 5 (6.4)        |          |       |
|                         | Lower middle            | 22 (88)        | 3 (12)         |          |       |
| Socioeconomic status    | Upper lower             | 171 (90)       | 19 (10)        | 5.257    | 0.072 |
|                         | Lower                   | 118 (81.4)     | 27 (18.6)      |          |       |
|                         | Present                 | 51 (75)        | 17 (25)        |          |       |
| Family h/o hypertension | Absent                  | 260 (89)       | 32 (11)        | 9.248    | 0.002 |
|                         | No                      | 191 (93.6)     | 13 (6.4)       |          |       |
| Alcohol intake          | Yes                     | 120 (76.9)     | 36 (23.1)      | 20.978   | 0.000 |
|                         | No                      | 83 (96.5)      | 3 (3.5)        |          |       |
| Tobacco use             | Yes                     | 228 (83.2)     | 46 (16.8)      | 9.847    | 0.002 |
|                         | No                      | 16 (88.9)      | 2 (11.1)       |          |       |
| Extra salt intake       | Yes                     | 295 (86.3)     | 47 (13.7)      | 0.101    | 0.751 |
|                         | No                      | 75 (85.2)      | 13 (14.8)      |          |       |
| Physical activity       | Mild                    | 101 (85.6)     | 17 (14.4)      | 0.377    | 0.828 |
|                         | Moderate                | 135 (87.7)     | 19 (12.3)      |          |       |
|                         | Vigorous                | 46 (86.8)      | 7 (13.2)       |          |       |
| B.M.I                   | Underweight             | 179 (86.8)     | 27 (13.2)      | 0.347    | 0.952 |
|                         | Normal                  | 47 (83.9)      | 9 (16.1)       |          |       |
|                         | Overweight              | 39 (86.7)      | 6 (13.3)       |          |       |
|                         | Obese                   |                |                |          |       |

Table 3: Univariate &amp; Multivariable logistic regression analysis for the associated risk factors of hypertension

| Factors              | exposed % | unexposed % | cOR                 | aOR                  | P         |
|----------------------|-----------|-------------|---------------------|----------------------|-----------|
|                      |           | with HTN.   | with HTN.           | with C. I            | with C. I |
| Age in years (41-60) | 18.1%     | 7.7%        | 2.695 (1.336-5.242) | 2.578 (1.189-5.587)  | 0.016     |
| Family h/o HTN       | 25%       | 11%         | 2.708 (1.399-5.242) | 4.288 (1.941-9.472)  | <0.01     |
| Alcohol intake       | 23.1%     | 6.4%        | 4.408 (2.246-8.649) | 2.825 (1.282-6.225)  | 0.010     |
| Tobacco use          | 16.8%     | 3.5%        | 5.582 (1.690-18.43) | 3.319 (0.838-12.141) | 0.089     |

alcohol had over three times the odds of being hypertensive (AOR = 2.825; 95% CI: 1.282-6.226;  $p = 0.010$ ) compared to non-drinkers. Tobacco use initially appeared to be a strong risk factor (Crude Odds Ratio = 5.582,  $p = 0.005$ ), its adjusted association with hypertension was not statistically significant (AOR = 3.319; 95% CI: 0.838–12.141;  $p = 0.089$ ).

### **Discussion:**

The present study was undertaken to assess the prevalence of hypertension and its associated factors among the tribal population of Sambalpur district, Odisha. Out of 360 study participants, the prevalence of hypertension was found to be 13.6%.

The prevalence observed in this study (13.6%) is comparable to Sathiyarayanan et al.<sup>[14]</sup> (A cross-sectional study, multistage sampling technique, 952 tribal participants aged 18 and above, in Tirupattur Taluk, Vellore district) and Prajna Paramita Giri et al.<sup>[15]</sup> (A cross sectional study, the tribals of the Tangi-Chowdwar block of Cuttack district, 832 study subjects aged  $\geq 18$  years, multistage stratified random sampling) where hypertension prevalence among tribal populations was 16.7%. Similarly, S.A. Rizwan et al.<sup>[17]</sup> in their systematic review and meta-analysis, reported a pooled hypertension prevalence of 16.1% among Indian tribes. Some other studies reported a higher prevalence. For example, Nisha Meshram et al.<sup>[18]</sup> (47.3%, A community based cross sectional analytical study, 330 adult tribals, aged 25-60 years in Lohandiguda Block of Bastar District of Chhattisgarh), and Mohd Ashraf Ganie et al.<sup>[19]</sup> [41.4%, 6808 tribals aged  $>20$  yr (5695 Gujjars and 1113 Bakarwals) of Kashmir, using multistage cluster sampling technique.]. These differences may be attributed to geographical variations, cultural and lifestyle changes, and the age groups studied.

Regarding associated risk factors, age, family history of hypertension and alcohol consumption emerged as significant determinants in both univariate and multivariable analyses.

The average age of the participants was  $41.52 \pm 11.60$  years. The mean age for males was  $41.43 \pm 11.65$

years, and for females, it was  $41.63 \pm 11.58$  years. This observation was similar to the study by Nisha Meshram et al.<sup>[18]</sup> ( $41.6 \pm 10.2$  years), Priyanka Sajeeva et al.<sup>[20]</sup> ( $42.2 \pm 11.48$  years, 298 adults, Kani tribe in Thiruvananthapuram district, Multistage Cluster Sampling). Age was found to be an independent risk factor, with individuals aged 41–60 years having significantly higher odds of hypertension compared to those aged 18–40 years (AOR: 2.578; 95% C.I: 1.189-5.587;  $p = 0.016$ ). This is consistent with findings from multiple studies, including those by Meyiyanger Sanglir et al.<sup>[21]</sup> (urban tribal of aged 30-50 years in Nagaland, simple random sampling technique), and Vanishree Shriram et al.<sup>[22]</sup> (Cross sectional study, 502 Tribal Population of all men and women 40 years and above in hilly area in Vellore district, Tamil Nadu, Stratified Random Sampling) where age was positively associated with hypertension. Some other studies like Nisha Meshram et al.<sup>[18]</sup> (Cross sectional analytical study among adult tribal populations aged 25-60 years in Lohandiguda Block of Bastar District of Chhattisgarh) shows that age is not associated with hypertension. These differences may be attributed to geographical variations, Population Differences, Age Range Studied, cultural and lifestyle changes. Age-related vascular changes, including arterial stiffness and endothelial dysfunction, are well-established contributors to elevated blood pressure Franklin SS et al.<sup>[23]</sup> This middle-aged demographic is particularly critical, as hypertension tends to develop and accumulate risk in the fourth and fifth decades of life.<sup>[2]</sup>

A positive family history of hypertension was another significant predictor (AOR: 4.288, 95% CI: 1.941-9.472;  $p < 0.01$ ). This association aligns with findings from studies such as Mohd Ashraf Ganie et al.<sup>[19]</sup> and Priyanka Sajeeva et al.<sup>[20]</sup> where genetic predisposition was a major risk factor. The role of shared lifestyle factors and genetic susceptibility likely contributes to the familial aggregation of hypertension cases.

Alcohol consumption was found to increase the odds of hypertension significantly (AOR: 2.825; 95%

CI: 1.282-6.225;  $p=0.010$ ). This is similar to the findings by Meyiyanger Sanglir et al.,<sup>[21]</sup> Priyanka Sajeeva et al.,<sup>[20]</sup> and Bodhi Sri Vidya Vennam et al.,<sup>[24]</sup> (National Family Health Survey-5 data conducted in 2019–2021, 67263 tribal women and 8441 tribal men aged 15 to 49 years) observed alcohol intake as a consistent behavioural risk factor for hypertension among tribal groups.

Many studies like S. Sathiyarayanan et al.,<sup>[14]</sup> in 2019, Vani Kandpal et al.,<sup>[25]</sup> (Cross sectional study among 288, tribal population age between 20 and 60 years in India) & Tapas Chakma et al.,<sup>[26]</sup> (A cross-sectional study, cluster sampling, adult tribal population in Central India) founds no association with hypertension. These differences may be attributed to confounding factors or drinking pattern. Therefore, more longitudinal studies are required to clarify this relationship further.

In the present study, tobacco use was prevalent among 76.1% of participants, highlighting its widespread acceptance among the tribal community. Tobacco use showed a significant association with hypertension in univariate analysis ( $cOR=5.582$ ,  $p=0.005$ ), although the association not found to be significant in multivariate analysis ( $AOR = 3.319$ ; 95% CI: 0.838–12.141;  $p = 0.089$ ). Despite the loss of statistical significance, the elevated odds ratio suggests that tobacco remains an important risk factor, as also emphasized by Dhruvendra Lal et al.,<sup>[27]</sup> and Vanishree Shriraam et al.,<sup>[22]</sup> The high odds ratio suggests a potential independent effect, and the lack of significance could be due to a smaller sample size of non-tobacco users, and was found confounding with age and alcohol. Evidence from large datasets like NFHS-5 and the study by Prajna Giri et al.,<sup>[15]</sup> among Eastern Indian tribes have demonstrated significant associations between tobacco use and hypertension. Dhruvendra Lal et al.,<sup>[27]</sup> (NFHS-5 secondary analysis) found that daily smokers had a 1.2 times higher risk of hypertension compared to non-smokers. Though our study did not achieve statistical significance in multivariate analysis, the biological

plausibility and consistent findings elsewhere strongly suggest that tobacco control measures must be prioritized for hypertension prevention among tribal populations.

Physical activity levels and BMI (body mass index) were not significantly associated with hypertension in this study. This contrasts with several other studies, such as those by Dhananjay Kumar et al.,<sup>[28]</sup> and M.G. Deo et al.,<sup>[29]</sup> where obesity and sedentary lifestyles were significant predictors. One possible explanation could be the overall higher baseline physical activity among tribal populations engaged in agriculture and labour-intensive occupations.

Extra salt intake did not show a statistically significant association with hypertension in this study, although 95% of participants reported consuming extra salt. Previous studies, including Prajna Paramita Giri et al.,<sup>[15]</sup> have identified high salt intake as a risk factor. The absence of association in this study could be due to the widespread use of extra salt in this community. Another important observation was the relatively high level of awareness (59.2%) among hypertensives, compared to other studies like Palash Jyoti Misra et al.,<sup>[30]</sup> where awareness was as low as 24%. The control rates were still poor (only 20.6%), indicating gaps in treatment adherence or accessibility to effective management services.

### Limitation:

The cross-sectional design limits the ability to establish causal relationships between identified risk factors and hypertension; it only allows for the observation of associations. The study was confined to selected tribal areas of Sambalpur district and may not be generalizable to all tribal populations in Odisha. The study may be underpowered for multivariable logistic regression analysis, as the number of outcome events ( $n=49$ ) was limited, resulting in fewer than the recommended 10–20 events per predictor variable, which may affect the stability and precision of the adjusted odds ratios.

## Conclusions:

The study reveals that hypertension is a significant and growing public health concern among the adult tribal population of Sambalpur district, Odisha. Independent risk factors such as increasing age, positive family history of hypertension, and alcohol consumption emerged as significant contributors.

## Recommendation:

Regular community-based screening for hypertension should be strengthened among tribal populations to ensure early detection and timely management. Health education programs focusing on lifestyle modification should be implemented at the community level.

## Declaration:

Conflict of Interest: There is no conflict of interest.

Funding: Nil

Use of AI: ChatGPT was used only for language editing and grammar correction. It was not used for data analysis, interpretation, or generation of scientific content.

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## A Study on Proportion of Oral Premalignant Lesions and Its Associated Risk Factors Among Adult Population Attending Cancer Screening Outpatient Department at Tertiary Care Cancer Centre in Western Region, India

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### Abstract:

**Introduction:** In India, Oral cancer is the third most common cancer. In recent years, studies on the cancer focuses on early detection and timely intervention in Oral premalignant conditions because it plays a pivotal role for cancer prevention and improved patient outcomes. **Objectives:** To determine the proportion of individuals with suspected oral potentially malignant lesions detected through opportunistic visual oral screening among patients attending a tertiary care cancer screening outpatient department, and to evaluate the associated risk factors and clinical characteristics of these lesions. **Methods:** A Hospital based cross-sectional study was conducted among 501 individuals aged  $\geq 18$  years attending Cancer Screening OPD at GCRI, Ahmedabad. All participants underwent visual inspection of the oral cavity. A pre-validated questionnaire was used to obtain information regarding socio-demographic characteristics, behavioural risk factors, and symptoms suggestive of oral cancer. **Results:** The proportion of Oral Premalignant Lesion (OPML) in study population was 30.5%. Significant association was observed with older age group (OR=1.67, 95% CI 1.07-2.6), Males (OR=13.1, 95% CI 4.74-36.63) and illiterates (OR=3.32, 95% CI 2.23-4.9). Tobacco consumption ( $\chi^2=345.6$ ,  $p<0.001$ ) and poor oral hygiene ( $\chi^2=210.4$ ,  $p<0.001$ ) showed strong associations with OPML. On binary logistic regression, males were 20 times likely to show OPML compared to females (AOR= 20.42, 95% CI 7.15-58.3) and Illiterates were 4 times likely to affected by OPML compared to literates (AOR= 4.15, 95% CI 2.67-6.42). **Conclusion:** A high burden of OPML was detected through opportunistic screening, particularly among tobacco users and socio-demographically vulnerable groups. Strengthening community-level screening and risk reduction strategies is essential for early diagnosis and prevention of malignant transformation.

**Keywords:** Early Detection of Cancer, Oral premalignant lesions, Risk factors, Screening, Tobacco use.

### Introduction:

Oral cancer, including malignancies affecting the lips, tongue, floor of the mouth, and other oral cavity structures, constitutes a significant public health issue. In

South-Central Asia, oral cavity cancer is the third most common type of cancer.<sup>[1]</sup> In India, the age-standardized incidence rate of oral cancer is 12.6 per 1,00,000 populations.<sup>[1]</sup> Oral cancer may be preceded by clinically

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detectable non-malignant lesions, commonly referred to as oral potentially malignant disorders. Among these, Leukoplakia, Erythroplakia, and oral sub mucous fibrosis are the most frequently encountered lesions.<sup>[2]</sup>

The prevalence of leukoplakia in India ranges from 0.2% to 5.2%.<sup>[3]</sup> The prevalence of oral sub mucous fibrosis (OSMF) in India varies between 0.03% and 3.2%.<sup>[3]</sup> The incidence and prevalence of oral cancer have shown a concerning upward trend globally, necessitating a deeper understanding of its aetiology, pathogenesis, and optimal management.

In India, the prevalence of premalignant lesions varies with the screening setting, such as hospitals, communities, and primary care facilities. This variation in the prevalence of premalignant lesions can be attributed to regional, life style practices and cultural differences.<sup>[4, 5]</sup> Lifestyle-related practices such as tobacco smoking, alcohol consumption, chewing of tobacco or pan masala, and paan chewing are widely prevalent across various regions of the world. In South Asian countries, smokeless forms of tobacco account for a substantial proportion of overall tobacco consumption.<sup>[6]</sup>

Oral potentially malignant disorder and its sequelae may cause heavy impairment in quality of life; the disease is also highly costly for society. Primary prevention is considered the most cost-effective strategy, as it focuses on lowering the occurrence of potentially malignant disorders through modification of risk factors.<sup>[2]</sup> Although several studies from different regions of India have assessed the prevalence of oral potentially malignant lesions and their associated risk factors, evidence from the present region remains limited.

### Objectives:

The present study was conducted to determine the proportion of suspected oral potentially malignant disorders detected through opportunistic visual oral screening among individuals attending the cancer screening outpatient department of a tertiary care oncology centre in Western India. The study also aimed to describe the socio-demographic and behavioural

characteristics of individuals detected with suspected oral lesions, assess the distribution and clinical pattern of lesions according to anatomical site and appearance, examine the association of established risk factors such as tobacco and alcohol use with the presence of oral lesions, and determine the proportion of individuals requiring referral for further diagnostic evaluation and management following screening.

### Methodology:

This study was a hospital-based cross-sectional study conducted in Community oncology outpatient Department of the Gujarat Cancer Research Institute, a state-of-the-art cancer research facility situated in Ahmedabad from 1<sup>st</sup> May 2023 to 30th June 2023. A total 501 Individuals above 18 years of age, seeking health care services and consultation services from Cancer screening outpatient department were selected as study participants. The participants were briefed about the study objectives and procedures, following which informed consent was obtained.

In accordance with WHO–IARC guidelines, all participants underwent oral cavity examination for the detection of oral potentially malignant lesions, conditions, and oral cancer. Co-Investigators & Assistant Doctors were trained for screening of these lesions and Clinical detailed history was conducted by principal investigator and medical officers, who will record oral premalignant lesions & conditions. A pre-designed questionnaire which was validated by consultant of community oncology department were used to record the exposure of the subjects to known risk factors for oral pre cancer. Along with questions related to the type, frequency and duration of deleterious habits, the demographic information on characteristics such as age, sex, occupation, educational level, and socioeconomic status was also obtained. Visual examination of oral cavity was done using mouth mirror and probe. As a non-invasive technique, the oral cavity examination was performed quickly, is without additional diagnostic expense to the patient. The investigator looked for red and white lesions of the oral

mucosa and indurated and fixed masses through palpation. All those with oral lesions were counselled and referred to the Head and Neck Oncology Department for further management. Ethical approval obtained from Institutional Review Committee of The Gujarat Cancer and Research Institute (IRC/2024/P-18 dated 26/03/2024).

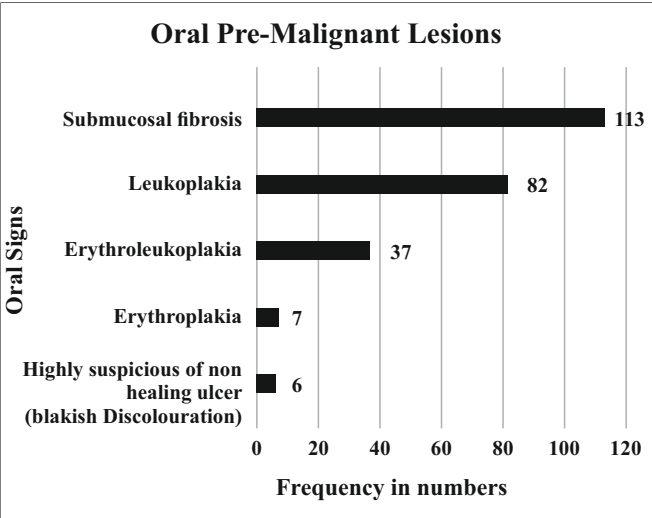
Results:

The study population comprised of 81% male and 19% female. The mean ( $\pm$  SD) age of the participants was 37.5 (SD  $\pm$  11.7) years and among them majority (74.6% females and 77.9% males) belongs to 25-54 years age category. More than half of the study participants (63.5%) were literate. The study further revealed that 86.2% of the participants were employed, the majority were married (84.4%), and a substantial proportion (62.7%) had a monthly income of less than 10,000 INR. [Table 1]

Table 1: Baseline Socio-demographic Profile of Participants (N=501)

| Baseline characteristics | Number | Percentage % |
|--------------------------|--------|--------------|
| <b>Age group (years)</b> |        |              |
| 15-24                    | 76     | 15.2%        |
| 25-54                    | 377    | 75.2%        |
| 54-64                    | 39     | 7.8%         |
| >65                      | 9      | 1.8%         |
| <b>Gender</b>            |        |              |
| Males                    | 406    | 81%          |
| Females                  | 95     | 19%          |
| <b>Marital Status</b>    |        |              |
| Ever Married             | 423    | 84.4%        |
| Never Married            | 78     | 15.6%        |
| <b>Literacy status</b>   |        |              |
| Literate                 | 318    | 63.5%        |
| Illiterate               | 183    | 36.5%        |
| <b>Monthly Income</b>    |        |              |
| <10000 rupees            | 314    | 62.68%       |
| 10000-20000 rupees       | 105    | 20.95%       |
| >20000 rupees            | 82     | 16.37%       |

Figure 1: Frequency of different Oral Pre-Malignant Lesions (OPML)



Assessment of tobacco and alcohol use among the study participants revealed that 165 (38.9%) had consumed tobacco in any form at some point in their lifetime. Among tobacco users, 73.8% reported the use of smokeless tobacco, indicating it as the predominant form of tobacco consumption in the study population. Additionally, nearly one-tenth of the participants were current alcohol users.

Among the total study population, 30.5% were identified with oral pre malignant lesions (OPML). Of these lesions, oral sub mucous fibrosis constituted the highest proportion (73.86%), followed by Leukoplakia (53.59%) and Erythroplakia (4.58%). Additionally, 60 (12%) participants reported at least one oral symptom, with ulcerative lesions involving the oral mucosa, tongue, or palate being the most commonly observed symptom (43.3%). [Figure 1]

Significant association was observed between OPML and older age group (OR=1.67, 95% CI 1.07-2.6), Males (OR=13.1, 95% CI 4.74-36.63) and Illiterates (OR=3.32, 95% CI 2.23-4.9). Tobacco consumption ( $\chi^2=345.6$ ,  $p<0.001$ ) and poor oral hygiene ( $\chi^2=210.4$ ,  $p<0.001$ ) were also strongly associated with OPML [Table 2]

Binary logistic regression analysis revealed that males had significantly higher odds of developing oral potentially malignant lesions compared to females

**Table 2: Factors associated with Oral Pre-malignant Lesion (N=501)**

| Characteristic       | OPML                       |                           | Chi-square | P-value |
|----------------------|----------------------------|---------------------------|------------|---------|
|                      | Present no.<br>(n=153) (%) | Absent no.<br>(n=348) (%) |            |         |
| Ever user of tobacco | Yes                        | 153                       | 42         | 345.6   |
|                      | No                         | 0                         | 306        | 0.000   |
| Gender               | Male                       | 149                       | 257        | 38.3    |
|                      | Female                     | 4                         | 91         | 0.000   |
| Education            | Illiterate                 | 86                        | 97         | 36.8    |
|                      | Literate                   | 67                        | 251        | 0.000   |
| Good oral hygiene    | No                         | 119                       | 42         | 210.4   |
|                      | Yes                        | 34                        | 306        | 0.000   |

**Table 3: Binary Logistic Regression among study participants**

|                 | B      | S.E. | Wald   | df | Sig. | Exp(B) | 95% CI for EXP(B) |        |
|-----------------|--------|------|--------|----|------|--------|-------------------|--------|
|                 |        |      |        |    |      |        | Lower             | Upper  |
| Gender          | 3.017  | .536 | 31.736 | 1  | .000 | 20.428 | 7.151             | 58.354 |
| Education level | 1.423  | .223 | 40.564 | 1  | .000 | 4.149  | 2.678             | 6.428  |
| Age             | .018   | .009 | 3.638  | 1  | .056 | 1.018  | 1.000             | 1.037  |
| Constant        | -4.762 | .663 | 51.658 | 1  | .000 | .009   |                   |        |

(AOR = 20.42; 95% CI: 7.15–58.3;  $p < 0.001$ ). Similarly, illiterate participants were nearly four times more likely to have oral potentially malignant lesions compared to literate participants (AOR = 4.15; 95% CI: 2.67–6.42;  $p < 0.001$ ). [Table 3]

### Discussion:

An opportunistic screening for oral potentially malignant lesions was carried out among attendees of the Community Oncology Outpatient Department of a tertiary care cancer institute in Western India. The burden of suspected oral precancerous lesions among the participants was 30.5% (95% CI: 12.3, 16.2), which was higher to the rate found in a population-based survey conducted in Indore, India, where it was 13.7%<sup>[7]</sup> and the prevalence observed in the present study was nearly ten times higher than that reported by Burungale SU et al. (2014), where the prevalence of oral potentially malignant lesions was 3.25%.<sup>[8]</sup> In India, the smokeless tobacco use is common among women.<sup>[9,10]</sup> Males had a higher prevalence ratio (PR) of suspected oral lesions after adjusting for substance use. Similar male

preponderance was noted in studies done at the Indore district of Madhya Pradesh.<sup>[7]</sup>

In the present study, oral sub mucous fibrosis (OSMF) was the most frequently observed oral potentially malignant lesion (73.86%), with the next most common lesion being Leukoplakia (53.59%), erythroleukoplakia (24.18%), Erythroplakia (4.58%), and highly suspicious non-healing ulcer (3.92%). A similar study conducted by Kumar et al. (2015) reported oral sub mucous fibrosis as the most prevalent lesion (8.06%), followed by Leukoplakia (4.02%) and lichen planus (1.38%), whereas Erythroplakia was the least commonly observed oral potentially malignant lesion (0.24%). In the present study, a comparatively lower proportion of highly suspicious non-healing ulcers (3.92%) and Erythroplakia (4.58%) was observed. The present study also shows that 12 % of study participants suffered from at least one of the oral symptoms and among them most commonly observed were trismus i.e., difficulty in opening mouth (8%). The proportion of participants with progressive restriction in mouth

opening observed in the present study was higher compared to that reported by Burungale et al. (2014).<sup>[8]</sup> However, it is lower compared to the study conducted at semi-urban district of Vidisha in Central India by Mehrotra et al., which reported difficulty in opening mouth to be 14% among their study participant.<sup>[11]</sup>

A study conducted by Pimple et al. (2012) noted that all individuals with oral precancerous lesions (OPML) were tobacco users.<sup>[12]</sup> which aligns with the findings of the current study. A similar association between tobacco use and oral potentially malignant lesions was reported by Burungale et al. (2014) and Kumar et al. (2015) (OR = 2.06,  $p = 0.030$ ). In the present study, all participants identified with oral potentially malignant lesions were tobacco users, with smokeless tobacco being the predominant form of consumption (74.5%). A statistically significant association was observed between tobacco use and oral potentially malignant lesions ( $\chi^2=345.6$ ,  $p<0.001$ ). These findings are consistent with studies conducted by Thomas et al. (2003) (OR = 37.8; 95% CI: 16.2-88.1), Mehrotra et al. (2010) (OR=4.5), and Sankaranarayanan et al. (1989) ( $p<0.001$ ), all of which demonstrated a significant association between tobacco chewing and oral potentially malignant lesions.<sup>[11,13,14]</sup>

Studies conducted by Kumar et al., (2015) (OR=2.09, 95% CI=1.45–3.00) and Pimple et al., (2012) ( $p<0.001$ ) showed that male gender was significantly associated with OPML.<sup>[7,12]</sup> These results are consistent with the present study, where among individuals who have ever used tobacco, those with oral precancerous lesions (OPML) had higher odds of being male compared to female (AOR= 20.42, 95% CI 7.15-58.3,  $p<0.0010$ ). The association observed in the present study was stronger than that reported by Pahwa et al. (2018), where male ever-tobacco users had higher odds of developing oral potentially malignant lesions compared to females (AOR = 12.22; 95% CI: 3.71–40.22).<sup>[15]</sup>

Interestingly, the results of the study also shows that a significant association was observed between OPML and older age group (OR=1.67, 95% CI 1.07-2.6), Males (OR=13.1, 95% CI 4.74-36.63) and Illiterates

(OR=3.32, 95% CI 2.23-4.9). The study further demonstrated that illiterate participants had significantly higher odds of developing oral potentially malignant lesions compared to literate individuals (AOR = 4.15; 95% CI: 2.67–6.42;  $p < 0.001$ ), which may be attributed to limited awareness, inadequate health education, and reduced access to preventive healthcare services. Illiteracy often correlates with lower socioeconomic status, which can result in poor nutrition, lack of awareness about the risks of tobacco and alcohol use, and limited access to regular health check-ups. Additionally, illiterate individuals may be less likely to recognize the early signs of OPML or seek timely medical advice, thereby contributing to a greater burden of the condition.

Among participants with OPML, only 3% reported being ever alcohol users, which is considerably lower than the findings reported by Pahwa et al. (2018), Juntanong et al. (2016), and Fioretti et al. in their respective studies (1999).<sup>[15,16,17]</sup> In the present study, individuals with oral precancerous lesions (OPML) did not have good oral hygiene ( $\chi^2=210.4$ ,  $p<0.001$ ). This finding is in agreement with a study conducted by Oji et al. (2012) in Nigeria, which reported a significant association between poor oral hygiene, particularly irregular tooth brushing and oral cancer ( $p<0.001$ ).<sup>[18]</sup> Similarly, a study conducted by Rosenquist et al. (2005) demonstrated a comparable association between poor oral hygiene and OPML, reporting an odds ratio of 5.3.<sup>[19]</sup>

The Occurrence of suspected oral mucosal lesions rises with age, with individuals aged over 60 years being 12.2 times more likely to have these lesions.<sup>[20]</sup> The present study also showed similar patterns, with majority of participants (>45 years) were significantly associated with OPML (OR=1.67, 95% CI 1.07-2.6). The National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Disease, and Stroke (NPCDCS) recommend screening for oral cancers in individuals aged 30 years and above. This strategy is considered efficient as it improves the yield during screening.<sup>[21]</sup>

Screening patients attending the outpatient department of a tertiary care hospital opportunistically is

a cost-effective and practical approach requiring minimal training. Screening can be conducted by visually inspecting the oral cavity using a torchlight and disposable tongue depressors. However, staining of the participant's mucous membrane by tobacco and Areca nut presented a challenge in diagnosing the lesions.

One potential limitation of the study could be social desirability bias, where participants, both male and female, might have underreported their tobacco and alcohol consumption frequency to conform to social expectations. Another limitation is the cross-sectional design, which raises questions about the temporal relationship between potentially malignant oral disorders and their associated risk factors. Additionally, it is recognized that other unmeasured or unaccounted risk factors may contribute to the development of these disorders, underscoring the need for further research in this area.

### Conclusion:

Although the study indicated prevalence of 30.5% oral potentially malignant lesions (OPML) in this population, a high proportion of individuals among them found to use tobacco in various forms and they do not have any oral symptoms with their long history of tobacco usage. This underscores the need to strengthen existing health programmes by integrating timely opportunistic screening of all suspected individuals at the community level. Such screening efforts can facilitate early diagnosis and preventive interventions for neoplasia, ultimately leading to improved public health outcomes. By strengthening screening programmes and enhancing awareness regarding the harmful effects of tobacco use, the burden of oral potentially malignant disorders may be substantially reduced, along with improvement in overall population health outcomes.

### Statements and Declarations

### Conflict of Interests

No conflict of interests have been declared by the authors. Authors declare no financial support or relationships that may pose conflict of interests.

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## Impact of Behaviour Change Communication on Immediate Complications of Gestational Diabetes Mellitus: A Prospective Quasi-Experimental Study

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### Abstract:

**Introduction:** Gestational Diabetes Mellitus (GDM) is an emerging public health concern in India and is associated with adverse maternal and neonatal outcomes. Behaviour Change Communication (BCC) is a cost-effective strategy that can promote healthy behaviours and improve pregnancy outcomes among women with GDM. This study aims to assess the impact of BCC on immediate maternal and neonatal complications of GDM among antenatal women. **Material and Methods:** A single-centre, prospective quasi-experimental study was conducted at a tertiary care teaching institute in a metropolitan city. Systematic enrolment of 220 antenatal women diagnosed with GDM between 24–28 weeks of gestation was carried out from a sampling frame of 285 GDM-positive clinic attendees. Participants were allocated to an intervention group (Group A, n=110) and a control group (Group B, n=110) using a structured alternate-day systematic pseudo-randomisation method. Group A received structured health education through BCC, while Group B received routine antenatal care. Participants were followed up during late pregnancy and up to six weeks postpartum. **Results:** The proportion of women who did not experience immediate maternal complications was significantly higher in Group-A (61.79%) than in Group-B (20.68%) ( $p<0.05$ ). A significantly greater reduction in post-prandial blood glucose levels was observed in the intervention group ( $p<0.05$ ). Neonatal complications were numerically lower in Group A, though the overall difference was not statistically significant. **Conclusions:** BCC significantly reduced immediate maternal complications and improved glycaemic control among women with GDM. Incorporating BCC into routine antenatal services may help reduce GDM-related morbidity.

**Keywords:** Gestational diabetes mellitus, Behaviour Change Communication, Maternal complications, Neonatal complications, Blood Sugar Level, Antenatal Care.

### Introduction:

According to the International Federation of Gynaecology and Obstetrics (FIGO) Initiative, Gestational Diabetes Mellitus (GDM) is any degree of glucose intolerance with onset or first recognition during pregnancy. The definition of GDM is evolving. When

hyperglycaemia detected during routine testing in pregnancy (generally between 24 and 28 weeks), it is called GDM<sup>[1]</sup>.

National guideline for diagnosis and management of Gestational Diabetes gives a single step test for diagnosis of GDM by using a 75-gm glucose, through

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Oral Glucose Tolerance Test and threshold value of 2-hour blood sugar  $>140$  mg/dL irrespective of the last meal.<sup>[2]</sup> GDM not only influences maternal complications (polyhydramnios, pre-eclampsia, prolonged labour, obstructed labour, caesarean section, uterine atony, postpartum haemorrhage and infection which are the leading global causes of maternal morbidity and mortality) but also neonatal complications (spontaneous abortion, intra-uterine death, stillbirth, congenital malformation, shoulder dystocia, birth injuries, neonatal hypoglycaemia and infant respiratory distress syndrome). Women with GDM and their offspring are at increased risk of developing type-2 diabetes later in life<sup>2</sup>. The Indian women have 11-fold increased risk of developing glucose intolerance during pregnancy compared to Caucasian women.<sup>[3]</sup> The incidence of GDM is expected to increase to 20% i.e. one in every 5 pregnant women is likely to have GDM.<sup>[3]</sup> According to the IDF Diabetes Atlas (2023), the global prevalence of hyperglycaemia in pregnancy is estimated at 13.9%, affecting approximately 21 million live births annually.<sup>[4]</sup>

Behaviour Change Communication is an interactive process with communities to develop tailored messages and approaches using a variety of communication channels to develop positive behaviours; promote and sustain individual, community and societal behaviour change; and maintain appropriate behaviours.<sup>[5]</sup> BCC has valid applications in both clinical settings and public health in the prevention of communicable and noncommunicable diseases.<sup>[5]</sup> Behavioural and educational interventions that address psychological elements - including perceived susceptibility, severity, benefits, and barriers - shape dietary habits, enhance self-efficacy, identify personal challenges to healthy behaviour, and cultivate intrinsic motivation for change, resulting in improved health-related quality of life among women at risk of or diagnosed with GDM.<sup>[6]</sup>

Despite the rising burden of GDM, awareness and implementation of preventive strategies remain inadequate, even among healthcare providers. Most existing studies focus on clinical management, with limited emphasis on behavioural interventions in routine antenatal settings. Behaviour Change Communication

(BCC) is a structured approach that motivates individuals to adopt and sustain healthy behaviours. However, evidence regarding its effectiveness in reducing immediate maternal and neonatal complications of GDM in real-world settings is limited. Therefore, the present study was undertaken to assess the impact of BCC on immediate complications of GDM among antenatal women.

## Material and Methods:

### Study Design and Setting:

A single-centre, prospective quasi-experimental study was conducted at the ANC clinic of a tertiary care teaching hospital in a metropolitan city from January 2018 to September 2019, following Institutional Ethics Committee approval. The study is designated quasi-experimental because, while group allocation employed a structured, pre-defined, investigator-independent criterion (calendar day of clinic attendance), formal allocation concealment was not employed.

### Ethics and Confidentiality:

Written informed consent was obtained from all participants. Participant data were anonymised using coded identifiers; no personally identifiable information was included in the analysis dataset. The study was conducted in accordance with the Declaration of Helsinki.

### Selection Criteria

#### Inclusion Criteria:

- (I) Antenatal women at 24–28 weeks of gestation with confirmed GDM (75-g OGTT, 2-hour postprandial blood glucose  $\geq 140$  mg/dL).
- (ii) Antenatal women previously diagnosed with GDM in the current pregnancy, confirmed by medical records.
- (iii) Those willing to participate and providing written informed consent.

#### Exclusion Criteria:

- (I) Antenatal women with pre-existing (pre-gestational) Type 1 or Type 2 diabetes mellitus.
- (ii) Antenatal women suffering from chronic renal disease, pancreatic disease, or other severe systemic illness.

- (iii) Antenatal women receiving steroids, nicotinic acid, or other medications known to cause dysglycaemia.
- (iv) Those not willing to participate in the study.

**Participant Enrolment:**

During the study period, 412 antenatal women were screened using the 75-g OGTT; 285 were diagnosed with GDM and constituted the sampling frame. Of these 285, all were assessed against the selection criteria; 240 fulfilled all inclusion and exclusion criteria. Of the 240 eligible women, 220 provided written informed consent and were enrolled; 20 declined participations.

Systematic random sampling was applied as the enrolment method: investigators attended the ANC clinic daily (Monday to Saturday) and systematically approached every eligible GDM-positive woman attending each clinic day in chronological order of attendance. This sequential, non-selective, clinic-population-based approach constitutes systematic random sampling as applied in community medicine research. Enrolment continued until the pre-determined target of 220 was achieved.

**Group Allocation:**

Enrolled participants were allocated to two equal groups of 110 using a structured alternate-day systematic pseudo-randomisation method: women attending on odd calendar days were assigned to Group A (BCC intervention group; n=110), and those attending on even calendar days to Group B (control/usual care group; n=110). This calendar-day-based allocation constitutes systematic pseudo-randomisation — an external, pre-defined, non-subjective criterion that eliminates investigator and participant selection bias. A single-blinding technique was applied: Group B participants were not informed of the BCC intervention delivered to Group A.

**BCC Intervention (Group A):**

Group A received structured health education through a validated BCC booklet developed using standard obstetrics and gynaecology references and national GDM management guidelines, with pictorial aids in the participant's preferred language. Three individual educational sessions were delivered: (i) at

enrolment (24–28 weeks); (ii) at first follow-up (34–38 weeks); and (iii) at second follow-up (within 6 weeks postpartum). Sessions covered: understanding GDM and its risks; dietary modification and glycaemic self-monitoring; safe physical activity during pregnancy; medication adherence; danger sign recognition; and breastfeeding and postpartum care. Group B received routine antenatal care only.

**Operational Definitions of Outcomes:****Immediate Complications of GDM:**

Those complications occurring due to GDM during pregnancy or within the first six weeks of the postpartum period.

**Immediate Maternal Complications:**

Pre-eclampsia/pregnancy-induced hypertension (PIH), polyhydramnios, prolonged labour (>18 hours in primigravidae; >12 hours in multigravida), obstructed labour, postpartum haemorrhage (>500 mL for vaginal delivery; >1000 mL for caesarean), puerperal sepsis/infection, abnormal gestational weight gain, miscarriage, uterine atony, and preterm delivery. Assessed clinically by the treating obstetrician at each follow-up visit and at delivery.

**Immediate Neonatal Complications:**

Neonatal hypoglycaemia (blood glucose <47 mg/dL), respiratory distress syndrome (Silverman-Anderson score  $\geq 3$  or SpO<sub>2</sub> <92%), macrosomia (birth weight >4 kg), neonatal jaundice requiring phototherapy (serum bilirubin >12 mg/dL in term neonates), polycythaemia, hypocalcaemia, intrauterine fetal death (IUFD), congenital malformation, and birth injuries. Identified through clinical examination by the paediatrician and neonatal case records within the first 28 days of life.

**Data Collection:**

A predesigned, pretested, and validated structured interview questionnaire was used at baseline and follow-up visits. Instruments included a sphygmomanometer (blood pressure), weighing scale and measuring tape (anthropometry), and ANC records (blood investigations). Follow-up visits were conducted at 34–38 weeks of gestation (first follow-up) and within six

weeks postpartum (second follow-up), either at the hospital or telephonically for women who delivered elsewhere. Telephonic follow-up used the same structured questionnaire; potential recall bias from this method is acknowledged as a study limitation.

### Statistical Analysis:

Data were entered in Microsoft Excel 2016 and analysed using SPSS version 25.0. Descriptive statistics (mean, SD, proportions/percentages) and inferential statistics (chi-square test, Fisher's exact test for cells with expected count <5, and unpaired t-test) were applied as appropriate. Data normality was assessed using the Shapiro-Wilk test prior to parametric testing.

### Result:

A total of 220 antenatal women with GDM were enrolled and allocated to Group A (BCC intervention) and Group B (Control group). During follow-up, 20 participants were lost (12 from Group A and 8 from Group B). Table no. 1 shows the socio-demographic distribution of participants in Group A & Group B.

Table no. 2 shows the comparison of immediate maternal and neonatal complications in both groups [Note: 'Immediate maternal complications' are defined as complications occurring from 34 weeks gestation through 6 weeks postpartum. 'Immediate neonatal complications' include those occurring within the first 28 days of life, diagnosed clinically or per standard laboratory thresholds].

In Group A, 61.79% of women had no immediate maternal complications compared to 20.68% in Group B, a statistically significant difference ( $\chi^2=30.63$ ,  $p<0.05$ ).

Absence of immediate neonatal complications was observed in 53.60% of Group A neonates and 40.59% of Group B neonates; however, this difference was not statistically significant ( $\chi^2=3.36$ ,  $p>0.05$ ). In both groups, jaundice was the most common complication (14.3% vs 26.5%), followed by hypoglycaemia (5.1% vs 18.6%) and respiratory distress (4.1% vs 14.7%), with macrosomia, congenital malformations, and intrauterine death occurring more frequently in Group B.

**Table No. 1: Sociodemographic profile of group A (n1: 110) & group B (n2: 110)**

| Variable                               | Group A<br>(Intervention group) | Group B<br>(Control Group) |        |
|----------------------------------------|---------------------------------|----------------------------|--------|
| <b>Age of the participants (years)</b> |                                 |                            |        |
| 17–21                                  | 1 (0.9%)                        | 21 (19.1%)                 |        |
| 22–26                                  | 49 (44.5%)                      | 23 (20.9%)                 |        |
| 27–31                                  | 38 (34.5%)                      | 35 (31.8%)                 |        |
| 32–36                                  | 16 (14.5%)                      | 29 (26.4%)                 | <0.001 |
| ≥37                                    | 6 (5.5%)                        | 2 (1.8%)                   |        |
| Mean ± SD                              | 27.82 ± 4.16                    | 27.66 ± 5.00               |        |
| <b>Education level</b>                 |                                 |                            |        |
| Illiterate                             | 18 (16.4%)                      | 14 (12.7%)                 |        |
| Primary school                         | 0 (0%)                          | 11 (10.0%)                 |        |
| Middle school                          | 61 (55.5%)                      | 56 (50.9%)                 | <0.001 |
| High school                            | 21 (19.1%)                      | 4 (3.6%)                   |        |
| Graduate                               | 10 (9.1%)                       | 25 (22.7%)                 |        |
| <b>Religion</b>                        |                                 |                            |        |
| 1. Hindu                               | 57                              | 56                         |        |
| 2. Muslim                              | 53                              | 46                         |        |
| 3. Christian                           | 00                              | 08                         |        |

Chi-square test for categorical variables; unpaired t-test for age.

**Table No.2: Immediate Maternal complications Group A (n1: 98) & group B (n2: 102)**

| <b>Immediate Maternal Complications</b>            | <b>Group A (n1=98)</b> | <b>Group B (n1=102)</b> | <b>p-value</b> |
|----------------------------------------------------|------------------------|-------------------------|----------------|
| <b>Polyhydramnios</b>                              | 8 (8.1%)               | 13 (12.7%)              | 0.31           |
| <b>Obstructed labour</b>                           | 7 (7.1%)               | 14 (13.7%)              | 0.12           |
| <b>Prolonged labour</b>                            | 2 (2%)                 | 11 (10.7%)              | 0.01           |
| <b>Infection</b>                                   | 8 (8.1%)               | 25 (24.5%)              | <0.01          |
| <b>PIH 12(12.2%)</b>                               | 19 (18.6%)             | 0.21                    |                |
| <b>Women with <math>\geq 1</math> complication</b> | 37 (37.7%)             | 82 (80%)                | < 0.001        |
| <b>No Maternal complication</b>                    | 61 (62%)               | 20 (19.46%)             | < 0.001        |

**Abbreviations:**

BCC- Behavioural Change Communication

GDM- Gestational Diabetes Mellitus

**Ethical Clearance Certificate:** Attached

The mean reduction in post-prandial blood sugar was significantly greater in Group A ( $-37 \pm 22.67$  mg/dl) than in Group B ( $-23.41 \pm 30.25$  mg/dl) ( $t = 3.75$ ,  $p < 0.05$ ). Normality of the blood glucose reduction data was assessed using the Shapiro-Wilk test. A confirmatory Mann-Whitney U test also demonstrated a significant intergroup difference ( $p < 0.05$ ), consistent with the t-test result. Normotension was observed in 90.38% of Group A participants compared to 77.35% in Group B, with a higher proportion of hypertensive subjects in Group B (22.64%) than Group A (9.61%).

Early initiation of breastfeeding occurred in 41.09% of Group A and 31.25% of Group B mothers, with no statistically significant difference ( $\chi^2=1.42$ ,  $p>0.05$ ). Exclusive breastfeeding was practiced by 80% of Group A and 84.37% of Group B mothers, and colostrum feeding by 94.73% and 90.62%, respectively; these differences were not statistically significant ( $p > 0.05$ ).

Among 33 participants advised pharmacological treatment, compliance was higher in Group A (87.5%) than Group B (76.4%), though the difference was not statistically significant ( $p > 0.05$ ).

**Discussion:**

The mean ages of participants were similar between the two groups (Group A:  $27.82 \pm 4.16$  years; Group B:  $27.66 \pm 5.00$  years) with no statistically significant difference on unpaired t-test ( $p=0.77$ ), confirming comparability of the groups in terms of average age. These findings are comparable to those reported by

Arjmandi Far et al.<sup>[7]</sup>, who noted a mean age of  $27.81 \pm 4.11$  years among GDM-positive antenatal women. However, while the mean ages were statistically comparable, the distribution of participants across age sub-groups differed significantly between the two groups (chi-square,  $p<0.001$ ). Specifically, the 17–21 years age sub-group comprised 21 women (19.1%) in Group B versus only 1 woman (0.9%) in Group A. These two observations — comparable means and different sub-group distribution — are not contradictory; they reflect different levels of statistical analysis of the same age variable. The larger standard deviation in Group B (5.00 vs 4.16) reflects greater age dispersion driven by the concentration of very young participants. Very young maternal age ( $<21$  years) is an established independent risk factor for adverse pregnancy outcomes, including PIH and obstructed labour, and constitutes a potential confounding factor that may partially explain the magnitude of the between-group difference in maternal complication rates. This distributional imbalance is an inherent limitation of the quasi-experimental design and is presented as a caveat when interpreting the results.

He et al.<sup>[8]</sup> demonstrated that structured health education combined with personalised care significantly reduced maternal complications and improved glycaemic control in women with GDM compared to routine care alone — findings that align with our results showing improved glycaemic control and significantly fewer immediate maternal complications in the BCC group.

The intervention group showed lower incidences of premature delivery, polyhydramnios, postpartum haemorrhage, fetal distress, and urinary tract infections, with no significant difference observed in placenta previa. These findings are consistent with the present study, where Behaviour Change Communication (BCC) resulted in improved glycemic control, a higher proportion of normotensive women, and significantly fewer immediate maternal complications in the intervention group. Together, these studies underscore the critical role of focused health education and behavior-based interventions in improving maternal outcomes in GDM, even when neonatal outcomes may not demonstrate statistically significant differences.

In the present study, infections were observed in 8% of women in Group A and 18% in Group B. Hafija Akter et al.<sup>[9]</sup> reported vaginal candidiasis in 12–24% of GDM patients, while Vijaya Nandhini Rengarajan et al.<sup>[10]</sup> documented a significantly higher incidence of urinary tract infections among GDM mothers compared to non-GDM mothers.

Pregnancy-induced hypertension (PIH) was noted in 12% of women in Group A and 18% in Group B. In comparison, Hafija Akter et al.<sup>[9]</sup> reported gestational hypertension in 28% of GDM cases, and Sahu L et al.<sup>[11]</sup> observed gestational hypertension in 35 women, indicating a higher prevalence than that observed in the present study. These discrepancies may reflect differences in diagnostic criteria (WHO vs ADA), the predominantly younger study population in our cohort, and the potential protective effect of the BCC intervention on blood pressure control through dietary and lifestyle modification.

Neonatal jaundice was the most common neonatal complication in the present study and was more frequent in Group A compared to Group B. Vijaya Nandhini Rengarajan et al.<sup>[10]</sup> similarly found high rates of neonatal hyperbilirubinemia among GDM mothers (85.7%), which is higher than observed in either group in our study — possibly reflecting more stringent diagnostic thresholds or a higher-risk population in that setting. These findings are consistent with reports by Kumari et al.<sup>[11]</sup> and Kwik et al.<sup>[12]</sup>, all of which highlight an increased risk of neonatal jaundice in GDM pregnancies.

Respiratory distress was observed in 4 neonates in Group A and 15 neonates in Group B. Vijaya Nandhini Rengarajan et al.<sup>[10]</sup> reported two cases of respiratory distress syndrome among neonates of GDM mothers, with none in the non-GDM group. The HAPO Study<sup>[13]</sup> further identified GDM as a significant risk factor for delayed fetal lung maturation and increased neonatal respiratory complications.

Neonatal hypoglycemia was noted in 5 neonates in Group A and 19 neonates in Group B. The HAPO Study<sup>[14]</sup> reported a higher prevalence of neonatal hypoglycemia among infants born to GDM mothers compared to non-GDM mothers (75% vs. 25%,  $p = 0.07$ ). These findings are supported by Kumari R et al.<sup>[11]</sup>, Abu-Heija AT et al.<sup>[14]</sup>, and Patel et al.<sup>[15]</sup>, who attributed this increased risk to fetal hyperinsulinemia—a compensatory response to maternal hyperglycemia during pregnancy.

This study highlights the significant role of behavioural interventions in improving maternal outcomes in GDM. Unlike purely clinical approaches, BCC addresses lifestyle modification, treatment adherence, and self-care practices, which are critical in glycaemic control. The lack of statistically significant difference in neonatal outcomes may be attributed to the shorter follow-up period and multifactorial determinants of neonatal health. Further multicentric studies with larger sample sizes and longer follow-up are recommended to establish the long-term impact of BCC interventions.

### Conclusion:

The present study demonstrates that Behaviour Change Communication (BCC) is an effective intervention in reducing immediate maternal complications among antenatal women with Gestational Diabetes Mellitus. Women who received BCC had better glycemic control and fewer maternal complications than those who did not receive the intervention. Although neonatal outcomes did not show statistically significant differences, fewer neonatal complications were observed among participants who received BCC. BCC proved to be a resource-efficient and scalable in improving key maternal health parameters among women with GDM. Strengthening such interventions

within routine antenatal care may help reduce GDM-related complications, especially in resource-limited settings.

**Declarations:**

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**Conflicts of Interest- Nil**

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## Risk factors and prevalence of antenatal psychiatric symptoms: A cross-sectional study in an underprivileged urban setting

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### Abstract:

**Introduction:** Antenatal psychiatric symptoms (APS) adversely affect maternal-foetal outcomes, and underprivileged urban communities are challenged with availability and accessibility to mental health services.

**Objectives:** To assess the prevalence and associated risk factors of APS in a hospital in an urban underprivileged setting.

**Methods:** This cross-sectional study was conducted at a government maternity hospital among 253 antenatal women using consecutive sampling. Women with gestation <24 weeks were screened for APS using Patient Health Questionnaire-9, Generalised Anxiety Disorder-7 and World Health Organisation's Alcohol, Smoking, and Substance Involvement Screening Test. Descriptive statistics and multivariable logistic regression analysis were performed.

**Results:** Prevalence of APS was 13.4%, with prevalence of depression 10.3%, anxiety 8.7%, alcohol use 0.8% and tobacco use 0.4%. Past history of self-harm attempts and spouse being a daily wage labourer were associated with APS. There is an absence of traditional risk factors like unplanned pregnancy, spousal alcoholism, intimate partner violence, problems with spouse, pressure to have a male child and poor social support.

**Conclusion:** APS is prevalent in urban, underprivileged backgrounds. Mental health screening during pregnancy is vital, especially for those with a history of self-harm.

**Keywords:** Antenatal psychiatric symptoms, Urban underprivileged setting, Prevalence, Risk factors, Maternal mental health

### Introduction:

Antenatal Psychiatric symptoms (APS), including depression, anxiety, and substance use, affects 21.8% of pregnant women in India.<sup>[1]</sup> This leads to adverse outcomes, including pre-eclampsia, prematurity, low birth weight, failure to thrive, and increased infant mortality.<sup>[2]</sup> APS is associated with reduced antenatal care, impaired nutrition and reduced care of self.<sup>[3]</sup>

Further, APS is associated with increased cortisol and reduced placental blood flow, leading to pre-eclampsia.<sup>[4]</sup>

All these factors can lead to adverse outcomes for the baby.<sup>[2]</sup> Known risk factors for APS include unplanned pregnancy, spousal alcoholism, intimate partner violence, problems with spouse, a history of psychiatric illness, poor social support, and pressure to have a male child.<sup>[1]</sup>

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Health care challenges reported by antenatal women in India include financial constraints, low literacy levels and poor healthcare access.<sup>[5]</sup> Conversely burden on healthcare due to APS include complications in children, including increased infection, hospitalization and incomplete immunisation.<sup>[6]</sup> Further, the National Mental Health Program does not focus on peripartum mental health and Maternal and Child Health programs have only recently introduced screening for APS in the antenatal care (ANC) card.<sup>[7]</sup> Stigma associated with mental health issues precludes the self-reporting of APS at ANC visits. Therefore, screening for perinatal mental health problems remains neglected, particularly for underprivileged populations who have poor availability and accessibility to mental health services.<sup>[8]</sup> Prevalence and risk factors of APS are understudied in underprivileged urban settings, and maternal mental health research in India has focused more on prevalence in hospital settings.<sup>[9]</sup> We aimed to determine the prevalence and factors associated with APS among women availing antenatal care at a government maternity hospital in an urban underprivileged area of Bengaluru.

## Methods:

### Study Setting and Design

This cross-sectional study was conducted at a government maternity hospital in Bangalore, serving an urban underprivileged population. This hospital refers women with severe and uncontrolled co-morbidities like gestational diabetes and hypertension to a tertiary centre. This study was a part of a larger longitudinal study, which recruited women at gestational age of <24 weeks and followed the cohort up to 6 months post partum. Following Institutional Ethics Committee (IEC 51/2022) approval, women were recruited from ANC after providing written informed consent. This study was conducted according to the Declaration of Helsinki 2013.

### Study population and sampling

The sample population included pregnant women attending the ANC. Based on a 15.6% mental disorder prevalence during pregnancy<sup>[10]</sup> 5% precision, 80% power and 95% confidence interval (CI), with a 25%

inflation for study drop-outs, the final sample size was calculated as 253. Participants were recruited via consecutive sampling between September 2022 and April 2023. Inclusion criteria were participants who were Kannada-speaking, aged  $\geq 18$  years, with a gestational age < 24 weeks. Women with a history of severe mental illness (e.g., psychotic or bipolar disorders) or serious medical illness that will preclude a meaningful interview were excluded.

### Study Tools

1. PHQ-9, a validated 9-item tool that was used to screen for depressive symptoms over the preceding 2 weeks, in antenatal women in Kannada.<sup>[11,12]</sup> Each scored from 0 ("not at all") to 3 ("nearly every day"), with a total score of 0-27. The PHQ-9 is classified as no/minimal (0-4), mild (5-9), moderate (10-19), and severe (20-27).
2. GAD-7 is a 7-item questionnaire used for screening anxiety symptoms in the past 2 weeks in antenatal women, validated in Kannada with a total score ranging from 0-21.<sup>[12,13]</sup> GAD-7 is classified into no/minimal (0-4), mild (5-9), moderate (10-14) and severe ( $\geq 15$ ).
3. Substance use was screened via the World Health Organisation's Alcohol, Smoking, and Substance Involvement Screening Test (WHO ASSIST) for use in antenatal women. It has a sensitivity of 79.7% and a specificity of 82.8%.<sup>[14]</sup> This was translated into Kannada and back-translated into English. WHO ASSIST for alcohol is classified into mild (1-10), moderate (11-26) and severe (27+). WHO ASSIST tobacco is classified into mild (1-3), moderate (4-26) and severe (27+).
4. Social support was measured via the Social Support Questionnaire (SSQ) which is a 12-item scale comprising six instrumental and six emotional support items. Participants responded using a 4-point Likert scale from 1 (definitely not enough) to 4 (definitely enough), ranging from scores 12-48.<sup>[15]</sup> Total mean scores of all items were used. Higher scores indicate good social support.
5. A structured questionnaire was used to collect sociodemographic (age, education, husband's

occupation, spousal alcoholism), obstetric (past abortions, planning of pregnancy) and psychosocial variables (e.g., intimate partner violence, gender preference of baby, history of self-harm). All the screening tools and the questionnaire were interviewer-administered. The psycho social variables, including history of self-harm before pregnancy, were elicited as a binary question (yes/no) by the interviewer.

The identity of the participants was anonymized using alphanumeric codes. Presence of APS was defined by the scores of  $\geq 5$  on the PHQ-9 or GAD-7 or  $\geq 1$  on the WHO ASSIST. Participants screening positive for APS or reporting suicidal ideation (PHQ-9 item 9) at the time of the study were referred to a psychiatrist.

### **Statistical Analysis**

Data was analyzed using STATA software (StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC). Categorical data, including sociodemographic, obstetric & psycho social variables, were reported as frequencies and percentages. Continuous data, including social support, were expressed as mean (SD). Socio-demographic, obstetric and psycho-social factors associated with APS were identified via univariate analysis. Significant variables ( $p < 0.05$ ) entered a multivariable regression model to determine adjusted odds ratios (AOR) with 95% CI.

### **Results:**

To achieve the sample size of 253, we had to consecutively screen a total of 320 women, 29 of whom declined to participate, and 38 did not meet the eligibility criteria. Of the 253 participants, the sociodemographic, obstetric, and psychosocial characteristics of the sample are detailed below.

The mean age was 24.7 years (SD = 4.2), with 207 women (81.8%) aged 20–30 and 20 (7.9%) under 19. Most were housewives (205, 81.0%), Hindu (138, 54.5%), and had completed higher secondary education (165, 65.2%). Regarding living arrangements, 92 women (36.4%) lived in joint families and 42 (16.6%) in extended families. Most (186, 73.5%) reported a monthly income of 6,768–20,273, with 231 (91.3%) being financially dependent on spouses. All spouses

were employed, with 144 (56.9%) in business or salaried employment and the rest as daily wage labourers (109, 43.1%).

Obstetrically, 113 women (44.7%) were primigravida, and 40 (15.8%) had third or higher pregnancy. Previous abortions were reported by 49 (19.4%), and 99 (39.1%) said that their current pregnancy was unplanned. Most (194, 76.7%) had no gender preference. Medical complications were rare: 3 (1.2%) had gestational diabetes and 5 (2.0%) had pregnancy-induced hypertension.

Psycho-socially, 10 women (4%) each reported intimate partner violence and marital discord, while 8 (3.2%) cited hostile in-laws. Spousal alcoholism was reported by 13 (5.1%). The overall social support score for our sample population was high, with a mean of 35.6 and standard deviation of 4.8. Sixteen women (6.3%) had a history of attempted self-harm before pregnancy. However, none reported suicidal ideas at the time of the study.

APS was identified in 34 women (13.4%). Depression was found in 26 (10.3%), with mild severity in 15 (5.9%) and moderate in 11 (4.3%); none had severe symptoms. Anxiety symptoms were present in 22 (8.7%), with mild severity in 10 (4%), moderate in 5 (2%), and severe in 7 (2.8%). Substance use was minimal, with 2 (0.8%) reporting alcohol use and 1 (0.4%) tobacco use; both had mild severity; no other substances were reported.

There was no history of known psychiatric illness before pregnancy. Factors associated with APS during pregnancy are presented in Table 1. In univariate analysis, family income and social support scores were associated with APS; however lost significance after adjustment, as shown in Table 1. None of the other sociodemographic, obstetric, or psychosocial factors was associated with APS in the univariate analysis. In multivariable regression analysis, as shown in Table 1, women whose husbands were daily wage labourers were four times more likely to have more psychiatric symptoms than those in other professions, such as business or salaried employment (AOR 4.46; 95% CI: 1.64-12.12;  $P=0.003$ ). Women with a history of

**Table 1: Risk factors associated with Antenatal Psychiatric symptoms (APS) in an urban underprivileged setting**

| Factors                           | Overall (n=253) | APS            |                | Crude odds ratio (95% C.I) | P-value | Adjusted odds ratio (95% C.I) | P-value |
|-----------------------------------|-----------------|----------------|----------------|----------------------------|---------|-------------------------------|---------|
|                                   |                 | Present (n=34) | Absent (n=219) |                            |         |                               |         |
| <b>Age bracket</b>                |                 |                |                |                            |         |                               |         |
| (≤19)                             | 20 (7.9%)       | 3 (8.8%)       | 17 (7.8%)      | Ref                        |         |                               |         |
| (20-30)                           | 207 (81.8%)     | 25 (73.5%)     | 182 (83.1%)    | 0.78 (0.21,2.85)           | 0.705   |                               |         |
| (>30)                             | 26 (10.3%)      | 6 (17.6%)      | 20 (9.1%)      | 1.7 (0.37,7.85)            | 0.496   |                               |         |
| <b>Education</b>                  |                 |                |                |                            |         |                               |         |
| Upto 5th                          | 45 (17.8%)      | 6 (17.6%)      | 39 (17.8%)     | Ref                        |         |                               |         |
| Upto 12th                         | 165 (65.2%)     | 24 (70.6%)     | 141 (64.4%)    | 1.11 (0.42,2.9)            | 0.837   |                               |         |
| Graduate & above                  | 43 (17.0%)      | 4 (11.8%)      | 39 (17.8%)     | 0.67 (0.17,2.55)           | 0.553   |                               |         |
| <b>Employment</b>                 |                 |                |                |                            |         |                               |         |
| Housewife                         | 205 (81.0%)     | 24 (70.6%)     | 181 (82.6%)    | Ref                        |         |                               |         |
| Laborer                           | 11 (4.3%)       | 3 (8.8%)       | 8 (3.7%)       | 2.83 (0.7,11.39)           | 0.144   |                               |         |
| Business/service                  | 37 (14.6%)      | 7 (20.6%)      | 30 (13.7%)     | 1.76 (0.7,4.44)            | 0.232   |                               |         |
| <b>Religion</b>                   |                 |                |                |                            |         |                               |         |
| Hindu                             | 138 (54.5%)     | 18 (52.9%)     | 120 (54.8%)    | Ref                        |         |                               |         |
| Muslim                            | 74 (29.2%)      | 7 (20.6%)      | 67 (30.6%)     | 0.7 (0.28,1.75)            | 0.442   |                               |         |
| Christian                         | 41 (16.2%)      | 9 (26.5%)      | 32 (14.6%)     | 1.88 (0.77,4.57)           | 0.166   |                               |         |
| <b>Family income</b>              |                 |                |                |                            |         |                               |         |
| <6767                             | 4 (1.6%)        | 2 (5.9%)       | 2 (0.9%)       | 17 (1.02,283.01)           | 0.048   | 10.61 (0.33,338.31)           | 0.181   |
| 6768-20273                        | 185 (73.1%)     | 23 (67.6%)     | 162 (74.0%)    | 2.41 (0.31,19)             | 0.403   | 2.1 (0.26,17.14)              | 0.49    |
| 20273-33792                       | 46 (18.2%)      | 8 (23.5%)      | 38 (17.4%)     | 3.58 (0.41,30.91)          | 0.246   | 2.59 (0.29,23.07)             | 0.394   |
| >33793                            | 18 (7.1%)       | 1 (2.9%)       | 17 (7.8%)      | RefRef                     |         |                               |         |
| <b>Husband employment</b>         |                 |                |                |                            |         |                               |         |
| Farmer/laborer                    | 109 (43.1%)     | 7 (20.6%)      | 102 (46.6%)    | 3.36 (1.10,8.05)           | 0.006   | 4.46 (1.64,12.12)             | 0.003*  |
| Business/service                  | 144 (56.9%)     | 27 (79.4%)     | 117 (53.4%)    | RefRef                     |         |                               |         |
| <b>Number of living children</b>  |                 |                |                |                            |         |                               |         |
| None                              | 121 (47.8%)     | 13 (38.2%)     | 108 (49.3%)    | Ref                        |         |                               |         |
| One                               | 100 (39.5%)     | 16 (47.1%)     | 84 (38.4%)     | 1.58 (0.72,3.47)           | 0.252   |                               |         |
| ≥2                                | 32 (12.6%)      | 5 (14.7%)      | 27 (12.3%)     | 1.54 (0.5,4.69)            | 0.449   |                               |         |
| <b>Number of abortions</b>        |                 |                |                |                            |         |                               |         |
| None                              | 203 (80.2%)     | 26 (76.5%)     | 177 (80.8%)    | Ref                        |         |                               |         |
| One                               | 37 (14.6%)      | 6 (17.6%)      | 31 (14.2%)     | 1.32 (0.5,3.46)            | 0.576   |                               |         |
| ≥2                                | 13 (5.1%)       | 2 (5.9%)       | 11 (5.0%)      | 1.24 (0.26,5.9)            | 0.789   |                               |         |
| <b>Pregnancy</b>                  |                 |                |                |                            |         |                               |         |
| Planned                           | 154 (60.9%)     | 16 (47.1%)     | 138 (63.0%)    | Ref                        |         |                               |         |
| Not planned                       | 99 (39.1%)      | 18 (52.9%)     | 81 (37.0%)     | 1.92 (0.93,3.96)           | 0.08    |                               |         |
| <b>Intimate partner violence</b>  |                 |                |                |                            |         |                               |         |
| Yes                               | 10 (4.0%)       | 3 (8.8%)       | 7 (3.2%)       | 2.93 (0.72,11.93)          | 0.133   |                               |         |
| No                                | 243 (96.0%)     | 31 (91.2%)     | 212 (96.8%)    | Ref                        |         |                               |         |
| <b>Hostile in-laws</b>            |                 |                |                |                            |         |                               |         |
| Yes                               | 8 (3.2%)        | 3 (8.8%)       | 5 (2.3%)       | 4.14 (0.94,18.2)           | 0.06    |                               |         |
| No                                | 245 (96.8%)     | 31 (91.2%)     | 214 (97.7%)    | Ref                        |         |                               |         |
| <b>Marital discord</b>            |                 |                |                |                            |         |                               |         |
| Yes                               | 10 (4.0%)       | 3 (8.8%)       | 7 (3.2%)       | 2.93 (0.72,11.93)          | 0.133   |                               |         |
| No                                | 243 (96.0%)     | 31 (91.2%)     | 212 (96.8%)    | Ref                        |         |                               |         |
| <b>Alcoholism in husband</b>      |                 |                |                |                            |         |                               |         |
| Yes                               | 13 (5.1%)       | 3 (8.8%)       | 10 (4.6%)      | 2.02 (0.53,7.76)           | 0.304   |                               |         |
| No                                | 240 (94.9%)     | 31 (91.2%)     | 209 (95.4%)    | Ref                        |         |                               |         |
| Social support                    | 35.6 ± 4.8      | 33.9 ± 5.8     | 35.8 ± 4.5     | 0.93 (0.87,1)              | 0.036   | 0.96 (0.88,1.03)              | 0.262   |
| <b>Self-harm before pregnancy</b> |                 |                |                |                            |         |                               |         |
| Yes                               | 16 (6.3%)       | 9 (26.5%)      | 7 (3.2%)       | 10.9 (3.74,31.82)          | <0.001  | 9.51 (2.84,31.88)             | <0.001* |
| No                                | 237 (93.7%)     | 25 (73.5%)     | 212 (96.8%)    | Ref                        |         |                               |         |

\*P value &lt; 0.05; Ref: Reference variable;

attempted self-harm before pregnancy had 10 times greater chance of APS compared to those with no history of self-harm. (AOR 9.51; 95% CI: 2.84-31.88;  $P < 0.01$ ). None of the other independent covariates remained significant in the regression model.

### **Discussion:**

Our study found that 13.4% of pregnant women had APS. This prevalence was similar to that found among rural women near Bangalore (15.3%)<sup>[16]</sup> but was lower compared to other Indian research.<sup>[17]</sup> In our study, antenatal depression was 10%. However, this is lower than antenatal depression (33%) elicited in the urban antenatal clinic during first trimester in Bengaluru.<sup>[18]</sup> This may be due to protective factors such as higher education levels, strong social support, and stable family structures and low rates of high-risk pregnancies in our study. The prevalence of anxiety was 8.7% in our study. Another study with a similar population had 55% anxiety in antenatal women less than 24 weeks gestation without pregnancy complications in a public sector hospital in Bengaluru.<sup>[19]</sup> But in the latter study anxiety was associated with poor social support, unlike our cohort.

The negligible rates of alcohol (0.8%) and tobacco use (0.4%) were found in this cohort. National Family Health Survey-5 reports a maternal prevalence of alcohol  $< 1\%$  and tobacco of 2.48% in Karnataka. Our study cannot be generalized to the state statistics. However, negligible rates of alcohol and tobacco use may be due to perceived social stigma, social desirability bias and underreporting.<sup>[20,21]</sup> Similarly, low reports of marital discord, intimate partner violence & gender preference of baby may indicate participant hesitation to disclose personal views and social desirability bias. Targeted intervention on perceived stigma may address underreporting of these variables.

The reported 6.3% prevalence of pre-pregnancy self-harm attempts in this study aligns with findings from a tertiary centre in Bangalore, where 7% of antenatal mothers reported suicidal ideation or attempts.<sup>[22]</sup> Notably, in our study, women with a history of self-harm attempts were ten times more likely to screen positive for

APS compared to those without such a history. So a history of self-harm is a strong “marker” for current perinatal mental health struggles. However, these findings should be interpreted with caution as this study was not powered to elicit risk factors in this population.

In our study, women had good social support. In this urban Bengaluru cohort, the presence of family during ANC visits likely contributes to high perceived social support. This finding contrasts with a systematic review indicating increased risks of women with APS in those who lacked robust support systems.<sup>[23]</sup> This could be due to half of our study subjects staying with an extended family/joint family. There could be a possible informal community support system, which requires further research.

Participants whose spouses were employed as daily wage labourers had higher likelihood of APS than those whose spouses had stable jobs like business or service, indicating the stressor of uncertain earnings that is experienced by daily wage earners. This alignment is with a cross-sectional study from Indonesia.<sup>[24]</sup> Spousal occupation may serve as a proxy marker for socioeconomic status, where greater financial stability acts as protective factor against APS. Aside from the husband’s occupation and previous history of self-harm, did not demonstrate a statistically significant association with any specific obstetric factors.” This could be due to low rates of high-risk pregnancy, which were referred to higher centres. The timing of screening less than 24 weeks precluded us from assessing obstetric risk factors. Several factors established in literature, including the number of living children, planned pregnancy or socio-demographic variables, failed to reach significance here, possibly because the sample size was powered for prevalence rather than for odds ratio of risk factors. Furthermore, sensitive issues like spousal alcoholism, problems with spouse or in-laws, gender preference of the baby, and intimate partner violence are better captured through qualitative interviews where a good rapport can be established. Reports from participants on spousal alcoholism were low. Husbands were not available during the ANC, and first-hand information about spousal alcoholism could not be obtained.

No specific risk factor could be ascertained in this study. High prevalence of APS and lack of risk factors point to the need for screening of all women for APS. Routine integration of maternal mental health screening can be integrated into ANC with special focus on women with a history of self-harm attempt. Recommendations can be made for capacity building for healthcare professionals to use ANC as an opportunity for screening for APS. We will need guidelines for referral pathways for the management of APS.

Study strengths include validated local-language tools and screening for a wide range of APS. Limitations include the cross-sectional design and social desirability bias in the context of psycho-social factors and substance use. The sample size was calculated on the basis of the prevalence of APS and as such may have been inadequate for multivariate analysis.

Directions for further research: A qualitative study may better elicit aspects of intimate partner violence and the gender preference of the baby.

## Conclusion:

This study found a 13.4% prevalence of APS. This was associated with a pre-pregnancy history of self-harm attempts and spousal occupation of daily wage labour. However, the limited risk factors in the urban underprivileged setting suggest mental health screening is required in all pregnant women, especially those with a history of self-harm attempts. These findings underscore the necessity of integrating mental health screening into routine antenatal care.

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## A Study of Mental Health Status among Cancer Patients in a Tertiary Care Hospital of Bhopal City – a Mixed Method study

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### Abstract:

**Background:** Cancer is a major global health problem and is frequently associated with anxiety and depression that remain unrecognized and adversely affecting treatment outcome. So, the present study aims to assess the prevalence of anxiety and depression among cancer patients. **Methods:** A hospital-based mixed-method cross-sectional study was conducted among 150 adult cancer patients attending the Oncology Department of a tertiary care hospital in Bhopal for 01 year. Hospital Anxiety and Depression Scale (HADS) was used to collect quantitative data and in - depth interview for qualitative data. Chi square test was applied to test the association between quantitative variables and thematic analysis for qualitative data. **Results:** The mean age of participants was predominantly above 40 years, with males constituting 53.3%. Breast cancer (23.3%) was commonly reported cancer. The prevalence of anxiety and depression was 37% and 29%, respectively. Anxiety showed a significant association with gender ( $p=0.032$ ) and cancer stage ( $p=0.002$ ), while depression was significantly associated with marital status ( $p=0.049$ ), socioeconomic status ( $p=0.033$ ), and cancer stage ( $p=0.022$ ). A strong positive correlation was observed between anxiety and depression scores ( $r=0.8524$ ). Qualitative analysis showed varied perception, financial insecurity and social stigma. **Conclusion:** A substantial proportion of cancer patients experienced anxiety and depression, particularly those with advanced-stage disease. Participants commonly reported fear, hopelessness, financial insecurity, social withdrawal, and concerns regarding the future. It highlights the need for routine mental health screening as a part of comprehensive cancer care.

**Keywords:** Cancer, Anxiety, Depression, Hospital Anxiety and Depression Scale (HADS), Mental Health, Mixed-Method Study,

### Introduction:

According to WHO, cancer is a leading cause of death worldwide, accounting for nearly 10 million deaths in 2020, or nearly one in six deaths.<sup>[1]</sup> Data from the literature shows the fact that patients with malignant diseases with mental disorders usually do not receive adequate treatment, despite the existence of effective

psycho-oncological interventions, especially for common problems such as depression and anxiety.<sup>[2]</sup> Due to social stigma and other reasons, most of the cancer patients do not discuss their psychological problems with treating physician. As a result, majority of psychological morbidities go unrecognized and untreated, so it becomes the most pressing and urgent

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issue of relevance to cancer patients and their families. These psychological problems, specially anxiety and depression can also impact on the disease course, morbidity, hospital stays, treatment compliance and efficacy, and possibly also prognosis and mortality.<sup>[3-4]</sup> A meta analysis showed that non-compliance was greater in patients with depression as compared to non depressed patients.<sup>[5]</sup> Therefore, it is important to identify patients developing psychological distress during the course of treatment, so that appropriate actions can be taken in time. A cross-sectional analysis of routinely collected clinical data demonstrates that 73% of cancer patients with a diagnosis of depression are not receiving potentially beneficial care for their illness.<sup>[6]</sup> Some patients were taking antidepressants and antipsychotic drugs to manage their mental health during their cancer treatment, while others did not.<sup>[7]</sup> Thus, treatment of psychological problems among cancer patients is an important issue in oncology. Psychiatric counselling offers the patient a place to express their worries and help them to regain hope to live as some patients start to separate themselves from the society after the diagnosis. Despite the presence of depression and anxiety among cancer patients, very little literature is available in India. There are very few studies found regarding the prevalence of these psychological issues among cancer patients in Bhopal city. So, in this context, present study was to be planned to find out anxiety and depression among cancer patients along with affecting socio demographic determinants and also to know their perceptions and attitude about their diagnosis.

## Methods:

### Study type

This was a cross-sectional observational study conducted at the hospital. It consisted of quantitative and qualitative data collection components.

### Study population

Convenience sampling was used to recruit patients (Out-patient and In-Patient department) diagnosed with any type of cancer and report to Department of oncology in a tertiary care hospital of Bhopal city during the period of data collection.

### Study Period

The whole study was carried out for 2 years and 6 months.

**Duration of data collection-** approximately 01 year (Dec 2024-Nov 2025)

### Sample size

The sample size was calculated using the formula  $n = 4pq/L^2$ , where  $p$  represents the estimated prevalence,  $q = (100 - p)$ , and  $L$  is the allowable error. Based on previous literature, the prevalence was assumed to be 39%; therefore,  $p = 39$  and  $q = 61$ . The relative precision was taken as 20.4% of the prevalence, giving an allowable error of 7.96. Substituting these values into the formula yielded a sample size of 150.34, which was rounded to 150 participants. Thus, a total of 150 patients with cancer were included in the study.<sup>[8]</sup>

### Inclusion criteria

1. All cancer patients above the age of 18 years.
2. Patients who give consent to participate in the study.

### Exclusion criteria

1. Patients with a history of psychiatric illness before the diagnosis of cancer
2. Critically ill patients

### Data collection procedures and instruments used

Convenience sampling was used to recruit the patients. The present study used mixed method approach for collecting data, i.e. both qualitative and quantitative.

### For collecting quantitative data

1. A pre-designed and semi- structured questionnaire was used, consisting of the following two sections-
  - (a) **Socio-demographic factors and medical history** - age, gender, religion, place of residence, marital status, occupation, socio - economic status, history of onset of symptoms, timing of probable diagnosis, duration and type of treatment, getting benefit from any government healthcare schemes and status of out-of-pocket expenditure and significant history of any previous hospitalization or illness of longer duration. After applying the Modified

BG Prasad Scale -year 2025, the socioeconomic status was consolidated into three categories: upper, middle, and lower class.<sup>[9]</sup>

- b) **Clinical data relevant with diagnosis of cancer** –type and stage of cancer, psychotropic medicine used, type of therapy, treatment regimens, current activity and symptoms burden.

2. **Hospital Anxiety and Depression Scale (HADS Scale)** - It is a 14-item questionnaire, consisting of two subscales: anxiety and depression. Each item is rated on a four- point scale, giving maximum scores of 21 for each anxiety and depression. Finding scores of 11 or more on either subscale are considered to be a significant ‘case’ of psychological morbidity, while scores of 8-10 represent ‘borderline’ and 0-7 ‘normal’.<sup>[10]</sup>

#### For collecting qualitative data

An in-depth interview technique was used with the support of audio-recording facilities. Interviews were unstructured and conducted in Hindi, the language commonly spoken in the study area. Audio recordings were transcribed verbatim. Each interview lasted approximately 40–45 minutes. The in-depth interviews were conducted by trained co-investigators involved in the conceptualization of the study. Approximately 60 patients participated in the qualitative component. The interviews explored participants’ perceptions and experiences of living with cancer, including the impact of the disease on their daily lives, the type of cancer and treatment being received, and issues related to their mental health and psychological well-being.

We tried to know the perception of patients, such as how they feel and what the impact of this disease is on their life, what type of cancer and what type of therapy they are undergoing, along with focusing on their mental health status.

#### Quality control

The validity of the study tool was ensured by conducting a pilot study on 10% of the sample size in the Hindi language.

#### Statistical analysis

Data were entered into MS Excel and exported to SPSS Version 26 for analysis. Variables were recoded and transformed before the final analysis.

For qualitative data - Thematic analysis was used to analyse the data. The data set was scrutinized multiple times and the audio were listened to keenly until it became familiar, then data were analysed through coding and each code was recognizable by its own features related to the research objective further these codes where used to form transcripts, it helped in identifying theme and sub-theme that were reviewed thoroughly to address the research question directly.

For quantitative data, The Categorical data were summarized in terms of frequency and percentage,

And for continuous variables, mean, median, mode and standard deviation were calculated to present the sociodemographic characteristics of study participants. Chi-square test applied to test the association between the prevalence of anxiety and depression with sociodemographic factors and basic characteristics of cancer patients.

#### Ethical consideration

Ethical consideration was obtained from institutional level before starting of data collection from institute ethical committee. No-CMCH/IEC/2024/112 Date-31/08/2024. The anonymity of the study participants was kept confidential. Data collection was initiated only after getting written informed consent from participants after clearly explaining purpose, procedures, risks and benefits of study.

#### RESULTS:

The present study was undertaken to find out the prevalence of anxiety and depression and its associated sociodemographic factors and clinical details among cancer patients along with their perception and attitude about their diagnosis.

#### Interpretation of quantitative findings

Out of total study subjects, almost half of them aged 51- 80 years (46.6%) followed by age group between 40 – 50 years (40%). Male gender was found slightly higher compared with females (53.3% v/s 46.7%). Maximum

study participants (87%) belonged to Hindu religion; rest were from other religion. Mostly patients were married (80%) and remaining were unmarried, widowed and divorce (2%, 13%, 5%). Mostly patients were unskilled workers (44%) by occupation followed by clerical (32%) and skilled workers (12%). Farmers and housemaid contributed rest proportion by occupation (12%).

More than half of the participants lived in urban areas (56.7%), followed by rural areas (36.7%), while a small proportion (6.6%) belonged to semi-urban areas. Using modified BJ Prasad classification to assess the socioeconomic status, almost more than half belonged to middle class (56.7%) followed by lower class (37%). Very few (6.3%) had upper class.

Figure 1 shows the prevalence of anxiety 37% whereas Figure 2 shows the prevalence of depression 29% as per HADS score out of total study participants.

### Descriptive Statistics of Hospital Anxiety and Depression Scale (HADS) Scores Among Cancer Patients (N=150)

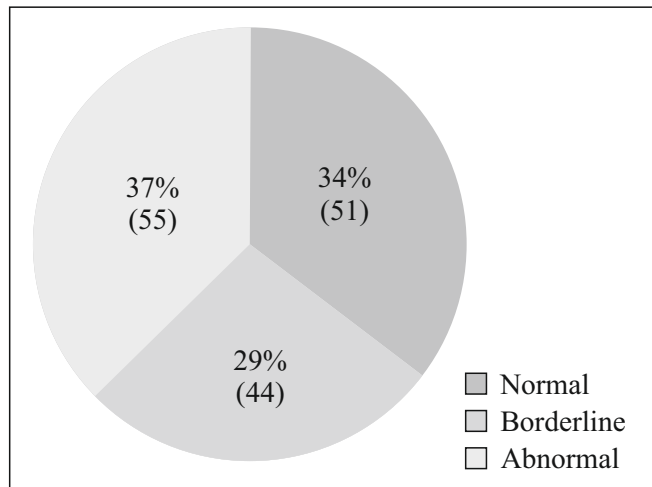
The mean HADS anxiety score among the study participants was  $9.27 \pm 2.38$ , with a median score of **10**, indicating that a substantial proportion of patients experienced moderate levels of anxiety. The mean HADS depression score was  $8.68 \pm 2.79$ , with a median score of **9**, suggesting the presence of considerable depressive symptoms among the participants. The relatively close mean and median values for both anxiety and depression indicate an approximately symmetrical distribution of HADS scores within the study population.

Figure 3 illustrates the relationship between HADS Anxiety scores (x-axis) and HADS Depression scores (y-axis) among the study participants. Each point represents an individual observation. The distribution of points shows an overall upward trend, indicating that higher anxiety scores are generally associated with higher depression scores. This pattern is further supported by the fitted linear regression line, which has a positive slope, suggesting a positive correlation between

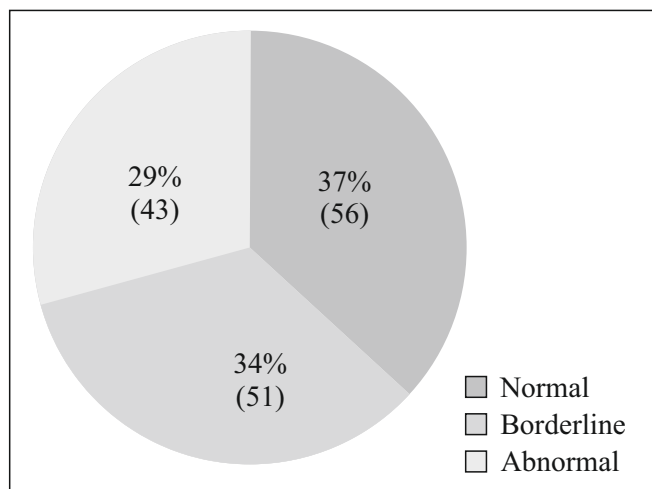
**Table 1: Basic characteristics of Cancer Patients (N=150)**

| Variable                          | Category               | N  | %    |
|-----------------------------------|------------------------|----|------|
| Type of Cancer                    | Breast Cancer          | 35 | 23.3 |
|                                   | Cervical Cancer        | 25 | 16.7 |
|                                   | Oral/Tongue Cancer     | 20 | 13.3 |
|                                   | Lung Cancer            | 15 | 10.0 |
|                                   | Stomach/Gastric Cancer | 12 | 8.0  |
|                                   | Prostate Cancer        | 10 | 6.7  |
|                                   | Colon/Rectal Cancer    | 8  | 5.3  |
|                                   | Other Cancers          | 25 | 16.7 |
| Cancer Stage                      | Stage I                | 35 | 23.3 |
|                                   | Stage II               | 60 | 40.0 |
|                                   | Stage III              | 40 | 26.7 |
|                                   | Stage IV               | 15 | 10.0 |
| Duration Since Diagnosis (Months) | < 6                    | 85 | 56.7 |
|                                   | 6–12                   | 55 | 36.7 |
|                                   | > 12                   | 10 | 6.7  |
| Type of Treatment                 | Chemotherapy           | 70 | 46.7 |
|                                   | Surgery                | 40 | 26.7 |
|                                   | Radiation Therapy      | 25 | 16.7 |
|                                   | Combination Therapy    | 15 | 10.0 |

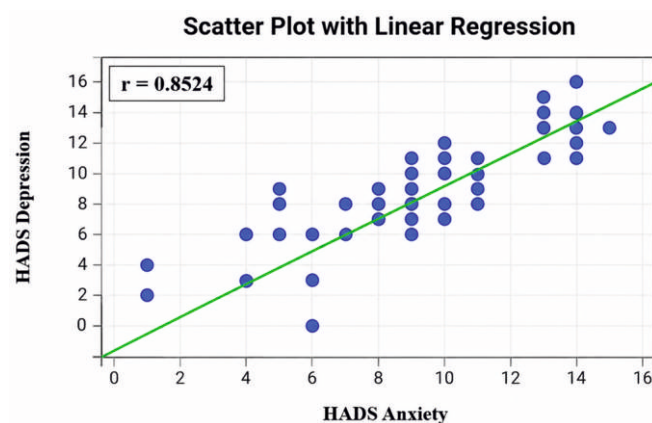
**Figure 1: Distribution of study participants as per Anxiety HADS score (N=150)**



**Figure 2: Distribution of Study Participants as per Depression Levels (N=150)**



**Figure 3: Correlation diagram between anxiety and depression (N=150)**



the two variables. Most data points are clustered between anxiety scores of 6–12 and corresponding depression scores of 6–12, indicating that moderate levels of anxiety are commonly associated with moderate levels of depression. A few points lie slightly away from the main cluster, but there are no extreme outliers significantly deviating from the trend. Overall, the plot demonstrates a moderate to strong positive linear relationship between anxiety and depression levels in the study population, with a correlation coefficient ( $r = 0.8524$ ).

Age ( $p = 0.306$ ), marital status ( $p = 0.250$ ), and education ( $p = 0.277$ ) were not significantly associated with outcome. However, only gender ( $p = 0.032$ ) showed statistically significant associations with outcome. A higher proportion of abnormal outcomes was observed among females (30.0%), unemployed individuals (40.0%), and participants belonging to the upper socioeconomic class (33.3%), whereas no abnormal cases were reported among those from the lower socioeconomic class.

The distribution across age groups showed no statistically significant association with outcome ( $p = 0.252$ ), although borderline cases were more frequent in individuals above 40 years. Gender also did not show a significant association ( $p = 0.127$ ), but females had a higher proportion of borderline and abnormal cases compared to males. Marital status demonstrated a significant association ( $p = 0.049$ ), with unmarried individuals showing a higher proportion of borderline cases. Education was also not significantly associated ( $p = 0.096$ ), as illiterate participants had the highest abnormal proportion, while graduates had predominantly borderline and fewer abnormal cases.

Occupation showed a significant association ( $p = 0.058$ ) with unskilled workers having higher abnormal proportions, whereas skilled individuals had relatively more normal outcomes. Socioeconomic class was also significantly associated ( $p = 0.033$ ), with the upper class showing higher abnormal proportions, while the lower class had no abnormal cases and equal distribution of normal and borderline categories.

Table 4 - Association of Sociodemographic variables with anxiety (N=150)

| Variable            | Category           | Normal, n (%) | Borderline, n (%) | Abnormal, n (%) | $\chi^2$ | p value |
|---------------------|--------------------|---------------|-------------------|-----------------|----------|---------|
| Age (years)         | <40                | 8 (26.7)      | 10 (33.3)         | 12 (40.0)       | 4.82     | p=0.306 |
|                     | 40–60              | 12 (30.0)     | 15 (37.5)         | 13 (32.5)       |          |         |
|                     | >60                | 10 (33.3)     | 18 (60.0)         | 2 (6.7)         |          |         |
| Gender              | Male               | 20 (40.0)     | 18 (36.0)         | 12 (24.0)       | 6.91     | p=0.032 |
|                     | Female             | 10 (20.0)     | 25 (50.0)         | 15 (30.0)       |          |         |
| Marital Status      | Married            | 18 (30.0)     | 25 (41.7)         | 17 (28.3)       | 2.77     | p=0.250 |
|                     | Unmarried          | 12 (30.0)     | 18 (45.0)         | 10 (25.0)       |          |         |
| Education           | Illiterate         | 5 (20.0)      | 10 (40.0)         | 10 (40.0)       | 5.10     | p=0.277 |
|                     | Primary/Secondary  | 15 (30.0)     | 20 (40.0)         | 15 (30.0)       |          |         |
|                     | Graduate and above | 10 (40.0)     | 13 (52.0)         | 2 (8.0)         |          |         |
| Occupation          | Unemployed         | 5 (20.0)      | 10 (40.0)         | 10 (40.0)       | 7.45     | P=0.114 |
|                     | Labour             | 10 (25.0)     | 18 (45.0)         | 12 (30.0)       |          |         |
|                     | Service/Business   | 15 (42.9)     | 15 (42.9)         | 5 (14.2)        |          |         |
| Socioeconomic Class | Upper              | 5 (16.7)      | 15 (50.0)         | 10 (33.3)       | 8.22     | P=8.22  |
|                     | Middle             | 15 (30.0)     | 18 (36.0)         | 17 (34.0)       |          |         |
|                     | Lower              | 10 (50.0)     | 10 (50.0)         | 0 (0.0)         |          |         |

Table 5 - Association of Sociodemographic variables with depression (N=150)

| Variable            | Category           | Normal, n (%) | Borderline, n (%) | Abnormal, n (%) | $\chi^2$ | p value |
|---------------------|--------------------|---------------|-------------------|-----------------|----------|---------|
| Age (years)         | <40                | 10 (33.3)     | 12 (40.0)         | 8 (26.7)        | 5.36     | p=0.252 |
|                     | 40–60              | 12 (30.0)     | 18 (45.0)         | 10 (25.0)       |          |         |
|                     | >60                | 8 (26.7)      | 15 (50.0)         | 7 (23.3)        |          |         |
| Gender              | Male               | 22 (44.0)     | 18 (36.0)         | 10 (20.0)       | 4.12     | p=0.127 |
|                     | Female             | 8 (16.0)      | 27 (54.0)         | 15 (30.0)       |          |         |
| Marital Status      | Married            | 20 (33.3)     | 25 (41.7)         | 15 (25.0)       | 6.02     | p=0.049 |
|                     | Unmarried          | 10 (25.0)     | 20 (50.0)         | 10 (25.0)       |          |         |
| Education           | Illiterate         | 5 (20.0)      | 10 (40.0)         | 10 (40.0)       | 7.88     | p=0.096 |
|                     | Primary/Secondary  | 15 (30.0)     | 22 (44.0)         | 13 (26.0)       |          |         |
|                     | Graduate and above | 10 (40.0)     | 13 (52.0)         | 2 (8.0)         |          |         |
| Occupation          | Unskilled          | 5 (20.0)      | 12 (48.0)         | 8 (32.0)        | 9.11     | p=0.058 |
|                     | Clerical           | 10 (25.0)     | 20 (50.0)         | 10 (25.0)       |          |         |
|                     | Skilled            | 15 (42.9)     | 13 (37.1)         | 7 (20.0)        |          |         |
| Socioeconomic Class | Upper              | 5 (16.7)      | 15 (50.0)         | 10 (33.3)       | 10.45    | p=0.033 |
|                     | Middle             | 15 (30.0)     | 20 (40.0)         | 15 (30.0)       |          |         |
|                     | Lower              | 10 (50.0)     | 10 (50.0)         | 0 (0.0)         |          |         |

Table 4: Association Between Cancer Stage, Anxiety Levels, and Depression Levels Among Cancer Patients (N = 150)

| Cancer Stage      | Anxiety Levels  |                     |                   | Depression Levels |                     |                   |
|-------------------|-----------------|---------------------|-------------------|-------------------|---------------------|-------------------|
|                   | Normal<br>n (%) | Borderline<br>n (%) | Abnormal<br>n (%) | Normal<br>n (%)   | Borderline<br>n (%) | Abnormal<br>n (%) |
| Stage 1           | 20 (57.1)       | 10 (28.6)           | 5 (14.3)          | 22 (62.9)         | 8 (22.9)            | 5 (14.2)          |
| Stage 2           | 20 (33.3)       | 22 (36.7)           | 18 (30.0)         | 18 (30.0)         | 20 (33.3)           | 22 (36.7)         |
| Stage 3           | 10 (25.0)       | 12 (30.0)           | 18 (45.0)         | 8 (20.0)          | 10 (25.0)           | 22 (55.0)         |
| Stage 4           | 5 (33.3)        | 7 (46.7)            | 3 (20.0)          | 4 (26.7)          | 5 (33.3)            | 6 (40.0)          |
| $\chi^2$ (df = 6) | 20.84           |                     |                   | 14.72             |                     |                   |
| p value           | .002*           |                     |                   | .022*             |                     |                   |

## **Interpretation of Qualitative findings**

Thematic analysis was carried out based on the audio recordings and four major themes were derived. These themes were further processed, analysed and broken down into subthemes.

### **Theme 1 – Illness perception and belief system**

#### **Subtheme -Variable perception towards illness**

On qualitative analysis, it was found that almost less than half of participants had a positive perception about their disease whereas few believed that it is a matter of fate.

#### **Subtheme – Spiritual attribution of their disease**

Very few participants said that it is not a disease, it is a kind of punishment given by God. One male participant told that “Ye sab pichhle karmo ka hisab hai, jo mujhe is Janam me bhogna pad raha hai.” Another male participant quote was – “Ye mari Zindagi ka aakhiri chapter hai.”

(“This is the consequence of my past deeds, which I must suffer in this lifetime.” Another participant expressed feelings of hopelessness and acceptance of mortality by saying, “This is the final chapter of my life.”)

### **Theme 2 - Emotional response as an addictive mechanism with respect to illness**

#### **Subtheme – Initial shock and disbelief**

Many participants got shocked to hear to have this deadly disease first time. It took very long time to accept that they have been diagnosed cancer.

#### **Subtheme -Optimistic attitude**

On the other hand, many other participants accepted this in a positive note. One of them told that, “Chahe kuchh bhi ho jaye, me aakhiri saans tak is bimari se lad kar hi rahuga.” Another statement received by one participant is – “Achha hua jo mujhe samay par pata chal gaya.”

(“No matter what happens, I will keep fighting this disease until my last breath. It is good that I found out about it in time.”)

#### **Subtheme – Hopelessness**

But very few have lost the hope from life when they came to know first time about this diagnosis. Two participants said that “Ab mere jeevan me kuchh bhi nahi bacha hai”

(“There is nothing left in my life now.”)

### **Theme 3 Impact on daily life**

#### **Subtheme – dependency on family members and Social withdrawal/isolation -**

On further analysis, it was found that majority faced very much difficulty in doing routine activities. About half of them were dependent on their family members. Many of them withdraw themselves from society / social interactions.

#### **Subtheme — Financial insecurity**

A few participants were informed about the loss of job , leading to financial crisis. Few participants were also worried about their financial condition in spite of availing government health care schemes. Many said that – “Sarkar ka sara paisa to bimari ki jach me hi chala gaya hai. Elaz ka to muhe meri bachat se hi dena pad raha hai.”

(“All the government assistance has been spent on diagnostic tests for the disease. I have to pay for the treatment from my own savings.”)

One of participant quote – “Is bimari ne to mujhe puri tarah nichod liya hai. Mere bad mere Parivar ka kya hoga. Shaya prabhu hi rasta dikhaye”

(“This illness has completely drained me. What will happen to my family after I am gone? Perhaps only God can show the way.”)

### **Theme 4 Social experience and stigma**

#### **Subtheme – Varied social experience**

Many participants never faced any kind of stigma, but very few experienced this. One participant told that “Jab se samaj me meri bimari ke barre me pata chala hai, mujhse sampark karna hi band kar diya hai. Mujhe dekh kar katrate hai.”

(“Ever since people in the community learned about my illness, they have stopped contacting me. They avoid me whenever they see me.”)

Another quote was – “Jin logo ki maine madad ki, unke bure waqt me saath diya, wo hi log aaj mujhse kanni kat rahe hai.”

(“The very people whom I helped and supported during their difficult times are now avoiding me.”)

### Subtheme – Self blaming

Very few blamed themselves having this disease. One participant quote was like – “Mujhe ghar se nikalne ka mann hi nahi hota hai, ek sharmindi si mahsus hoti hai.”

(“I do not feel like leaving the house anymore; I constantly feel a sense of shame.”)

Thus, by qualitative analysis, it is found that cancer affects almost all dimensions of a person’s life, be it physical, mental, social and financial.

Overall, this study resulted in the majority of cancer patients experiencing anxiety and depression as they learned about their cancer diagnosis. It specially formed more in patients knowing their stage 3 and stage 4.

### Discussion:

The present study was conducted to find out the prevalence of anxiety and depression and their associated sociodemographic factors and clinical details among cancer patients, along with their perception and attitude about their diagnosis.

The present study was carried out to find out the prevalence of anxiety and depression in cancer patients coming at tertiary care hospital for treatment. About half (46.6%) of study participants having more than 50 years, males are slightly outnumbering than females (53.3 v/s 46.7%). Maximum 86.7 % study participants belonged to Hindu religion with 56.7 % were from urban residence.

In our study, it was revealed that breast cancer (23.3%) was much more common followed by cervical cancer (16.7%) and oral cancer (13.3%). Nearly less than half patients (40%) were having stage 2 followed by stage 3 (26.7%).

Kumar S et al. (2016), which reported a higher prevalence of anxiety and depression among cancer patients, particularly in advanced stages of the disease. This shows that 56.7% and 64.2% patients were

suffering from anxiety and depression, respectively. There were significant relationships in relation to family history, past history and socioeconomic history with anxiety and depression.<sup>[3]</sup>

Using the HADS scale, the prevalence of anxiety and depression was found to be 36.6% and 29.3%, respectively. These findings are comparable with several previous studies. Similarly, Nabi et al. at Kashmir (2026) observed a very high burden of psychological morbidity, where 75.6% patients had abnormal anxiety levels and more than half had moderately severe depression, with significant association of anxiety and depression with marital status and age, again indicating higher levels compared to the present study.<sup>[4]</sup>

In comparison, Marik et al. from Northern India (2022) reported the prevalence of anxiety (34.6%) and depression (40.3%), where anxiety levels are almost similar to the present study, but depression was slightly higher.<sup>[6]</sup> Likewise, Radhakrishnan et al. (2023), using the HAM scale, reported anxiety in 24.1% and depression in 32.7% of patients, which is quite comparable to the present findings. They also reported that breast and gastrointestinal cancers were more commonly associated with depression, which aligns with the present study, where breast cancer was the most common cancer.<sup>[7]</sup>

On the other hand, Venkatesh et al. at Chennai (2024) reported a lower prevalence of anxiety (6%) and depression (31%) among head and neck cancer patients using HAM scales. Their study population consisted predominantly of males (74%), with most patients in the 51–65 years age group, a large proportion being illiterate, unemployed, and belonging to lower socioeconomic status, with 71% being married. These sociodemographic findings are similar to the present study in terms of age distribution and socioeconomic characteristics, although psychological morbidity was lower, possibly due to different tools used.<sup>[11]</sup>

Similarly, Brar et al. at Udaipur (2025) found a much lower prevalence of severe anxiety and depression (6.67%) using HAM-D scale, with most patients above 50 years and a male predominance, which is consistent with the age and gender distribution seen in the present study but differs significantly in prevalence rates.<sup>[12]</sup>

In contrast, **Kaphle et al.** at Nepal (2024) found that the majority of patients belonged to the 51–60 years age group, with females constituting 59.6%. They reported that most patients had mild (56.4%) to moderate (31.8%) depression, and mild (35.9%) to moderate (29.1%) anxiety, with very few severe cases. This pattern of predominantly mild to moderate psychological distress is similar to the present study, where moderate levels were more common than severe forms. They also reported that most patients were in stage 2 and stage 3, which is comparable with the staging distribution observed in the present study.<sup>[13]</sup>

Further, Arora et al. (2019) reported a lower prevalence of anxiety (20.3%) and depression (24.8%), which is less than that observed in the present study.<sup>[14]</sup> Sharma et al. (2021) reported that anxiety and depression were more common in head and neck malignancies, highlighting the role of cancer type.<sup>[15]</sup> Additionally, Sharma et al. at Shivpuri, Madhya Pradesh (2025) reported the prevalence of depression (31.25%) and anxiety (15.6%), especially higher in stage IV disease, males, and middle-aged groups, which partially aligns with the present study in terms of age and gender distribution.<sup>[16]</sup>

The present study demonstrates a clear trend of worsening psychological status with advancing cancer stage. In Stage 1, the majority of patients were within the normal category (57.1%), with relatively fewer showing borderline (28.6%) and abnormal (14.3%) findings. However, as the disease progressed to Stage 2 and Stage 3, there was a noticeable decline in normal cases (33.3% and 25.0%, respectively) and a corresponding rise in abnormal cases, which peaked in Stage 3 (45.0%). This suggests that disease advancement is associated with increased severity of the cancer, likely due to greater physical burden, treatment-related stress, and poorer prognosis. Interestingly, in Stage 4, although borderline cases were highest (46.7%), the proportion of abnormal cases (20.0%) was lower than in Stage 3. This could be attributed to factors such as psychological adaptation, smaller sample size or possible selection bias. Patients in advanced stages may develop coping mechanisms or may be under more intensive palliative and psychological support, influencing these findings.

Overall, the distribution indicates a progressive shift from normal to borderline and abnormal categories with advancing cancer stage, highlighting the importance of early psychological screening and intervention, especially in patients with higher-stage malignancies.

In the present study, a clear increasing trend of depression severity with advancing cancer stage was observed, with abnormal depression rising from 14.2% in Stage 1 to 55.0% in Stage 3, indicating a strong association between disease progression and psychological distress.

### Conclusion:

The present study demonstrates a considerable psychological burden among cancer patients, with 37% experiencing anxiety and 29% depression, and a positive correlation was found using HADS between the two ( $r = 0.85$ ). Socio-economic status and occupation were significantly associated with anxiety and depression. On qualitative findings, mixed types of perceptions (fear, stigma, financial insecurity) about the diseases were found using in-depth interviews.

### Recommendations

Based on the study findings, there is considerable proportion of cancer patients having anxiety and depression. There are variety of thought process concluded by patients about their deadly disease. So, keeping in this view, there should be appropriate psychiatric counselling of each and every cancer patient irrespective of their age, gender, occupation, type and staging of cancer. It would affect their mental health in positive direction and also would be able to improve the quality of life as well. In future, there should be establishment of Psycho-oncology units.

### Limitations

The study was conducted in a single tertiary care hospital; therefore, the findings may not be generalizable.

### Declaration of Findings

The study identified a considerable burden of anxiety and depression among cancer patients, with psychological distress increasing with advancing cancer stage. Significant associations were observed between

selected sociodemographic characteristics, cancer stage, and mental health status. Qualitative findings revealed diverse perceptions regarding cancer diagnosis, including fear, uncertainty, stigma, hope, and acceptance. These findings highlight the importance of integrating mental health services into routine oncology care to improve overall patient well-being and quality of life.

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## Knowledge, Attitude and Practices of Self-Monitoring of Blood Glucose among Diabetic Patients attending NCD Clinic at a Tertiary Care Hospital in Chennai: A Cross-sectional study

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### Abstract:

**Introduction:** Self-monitoring of blood glucose (SMBG) is a pivotal self-care measure in diabetes management, enabling better glycemic control and complication prevention. In India, however, the practice and awareness of SMBG remains limited, and factors influencing its use are insufficiently explored. **Objectives:** To assess the awareness, knowledge, attitude, and practices of self-monitoring of blood glucose and the factors associated with its awareness among type 2 diabetic patients. **Material Methods:** This study included 180 type 2 diabetic patients ( $\geq 18$  years) attending the NCD clinic of a tertiary care hospital in Chennai using consecutive sampling. Socio-demographic and diabetic profile alongside awareness, knowledge, attitude and practices of SMBG were assessed using a pretested semi-structured questionnaire. Data were analyzed in SPSS v21.0, using frequencies/ proportions for categorical variables and exact tests for socio-demographic associations. **Results:** Only 48.9% of participants were aware of SMBG. Among those patients with awareness ( $n=88$ ), healthcare professionals were the main source of information (52.6%), yet 35.9% of aware patients lacked practical knowledge on using a glucometer and 30.8% of them were unaware of the benefits. Also 88.5% ( $n=88$ ) expressed willingness to use glucometers if subsidized. Only 57.9% of aware patients ever used a glucometer. Awareness of SMBG showed significant association with age ( $p<0.001$ ) and education ( $p<0.001$ ). **Conclusion:** The study highlights substantial gaps in knowledge and practice of SMBG among type 2 diabetics, significantly influenced by socio-demographic factors like age and education. Strengthening patient education, clearing misconceptions, and improving access to affordable resources are crucial to enhance diabetes management.

**Keywords:** Blood Glucose Self-monitoring; Diabetes Mellitus, Type 2

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**Introduction:**

Diabetes is a chronic metabolic disease characterized by elevated blood glucose levels when the body produces little or no insulin or becomes resistant to insulin.<sup>1</sup> Long-term diabetes can cause damage to the body's tissues and organs, mainly blood vessels and nerves. Globally, around 830 million individuals suffer from diabetes with increasing prevalence in low- and middle-income countries.<sup>1</sup> Effective management of diabetes, especially Type 2 Diabetes, involves many strategies like lifestyle modification, pharmacotherapy and regular monitoring of blood glucose.<sup>2</sup>

One of the most important components of diabetes self-care and treatment is self-monitoring of blood glucose (SMBG).<sup>3</sup> By aiding in the modification of treatment doses, changes in lifestyle, and nutrition, SMBG provides optimal glycemic control and helps prevent hypoglycemia. The goal of SMBG is to measure blood sugar levels over a number of time points so that treatment can be adjusted to provide stable glucose levels.<sup>4,5</sup> Despite its numerous advantages, adherence to SMBG is very low.<sup>6</sup> Numerous studies have identified gaps in diabetic patients' knowledge, attitudes, and practices (KAP) about SMBG.<sup>7</sup> Socio-demographic variables like age, gender, education, occupation and income, play a significant role in the awareness and use of SMBG among diabetic patients.<sup>8,9,10</sup> The role of healthcare professional is also pivotal in improving the knowledge, attitude and practice of SMBG in diabetic patients by health education and counselling.

Understanding the awareness of SMBG and factors influencing its use is critical in creating effective education and intervention programs.<sup>4</sup> This study was done to assess the awareness, knowledge, attitude, and practices of self-monitoring of blood glucose and to assess the socio-demographic factors associated with the awareness of SMBG among type 2 diabetic patients. The results will provide a basis for identifying enablers and barriers to SMBG use and for planning of interventions to enhance self-management of diabetes in the community.

**Material and Methods:**

This hospital-based cross-sectional study was conducted among Type II Diabetes patients visiting the Non-Communicable Disease (NCD) Clinic of a tertiary care center in Chennai. The sample size was calculated based on the primary outcome variable-awareness regarding self-monitoring of blood glucose (SMBG). Based on the findings from a previous study by V. Krishnan et al<sup>11</sup>, which reported that 29.4% of individuals were aware of SMBG, and considering 7% margin of error, 10% non-response rate, the sample size calculated was 180 using the formula  $n = Z^2p(1-p)/d^2$ , adjusted for non-response. The study population includes patients aged 18 years or above who are diagnosed with Type 2 Diabetes Mellitus, are on treatment and follow up in the NCD clinic for a minimum duration of six months, are willing and able to understand and respond to the questionnaire in local language. Patients with Type 1 diabetes or gestational diabetes, critically ill, or with severe visual or motor disability, severe cognitive impairment or psychiatric illness which prevents self-monitoring of blood glucose were excluded. Ethical approval was obtained from the Institutional Ethics Committee (02/IEC/GOMC/2022) prior to data collection. The study participants were clearly explained about the study objectives, and written informed consent was obtained from all the participants.

After an extensive literature review and consultation with subject experts, a semi-structured questionnaire was developed in alignment with the study objectives. The questionnaire was pre-tested and refined based on expert feedback. It has two main sections: (i) Socio-Demographic profile, which includes variables such as age, gender, education and total family income. (ii) Assessment of Knowledge, Attitude, and Practice (KAP) of SMBG covering aspects related to self-monitoring of blood glucose, including frequency of testing, awareness of normal blood glucose levels, and reasons for not engaging in self-monitoring.

The participants were recruited from the NCD clinic using consecutive sampling until the target sample size was reached. Data collection was done through face-to-

face interviews using the semi-structured questionnaire. Responses were collected electronically via Google forms. Data analysis was performed using SPSS software version 21.0. Categorical variables were summarized as frequencies and proportions. Fisher's exact test was used to assess association between socio-demographic factors and awareness of self-monitoring of blood glucose.

### Results:

Table 1 shows, among the 180 study subjects interviewed, majority of them (48.9%) were in the age group of 50-70 years. Almost 42.8% had education up to higher secondary or diploma. Nearly half of them (50.6%) had monthly income in the range of Rs.10,000 to Rs.30,000 with a mean income of Rs. 25,556 ( $\pm 14,364$ ).

The mean duration of diabetes among study participants is 2.52 years ( $\pm 1.16$  years). Majority of them ( $n=131$ , 72.8%) were treated with oral anti diabetic drugs and most patients ( $n=61$ , 33.9%) preferred monitoring their blood glucose every third month (Table 2).

Figure 1 shows, only 48.9% of the study participants ( $n=88$ ) were aware of self-monitoring of blood glucose, while 51.1% ( $n=92$ ) were unaware.

Among 88 diabetic patients with awareness about SMBG, almost half the participants (52.6%) reported that they acquired knowledge about it through health care professionals. Of these, 56 patients (64.1%) knew how to use a blood glucose meter, while 32 patients (35.9%) did not. Additionally, 61 patients (69.2%) were aware of the benefits of SMBG, while 27 patients (30.8%) were not (Table 3).

**Table 1: Socio-demographic profile of the study participants (N =180)**

| Socio-demographic profile  |                           | Frequency (n) | Percentage (%) |
|----------------------------|---------------------------|---------------|----------------|
| Age Group(in years)        | <30                       | 17            | 9.5            |
|                            | 30-50                     | 62            | 34.4           |
|                            | 50-70                     | 88            | 48.9           |
|                            | >70                       | 13            | 7.2            |
| Gender                     | Male                      | 92            | 51.1           |
|                            | Female                    | 88            | 48.9           |
| Education                  | Illiterate                | 12            | 6.7            |
|                            | Up to high school         | 36            | 20             |
|                            | Higher secondary/ Diploma | 77            | 42.8           |
|                            | Graduate                  | 55            | 30.5           |
| Monthly income (in Rupees) | <10,000                   | 28            | 15.6           |
|                            | 10,000 - 30,000           | 91            | 50.6           |
|                            | 30,000-50,000             | 51            | 28.3           |
|                            | >50,000                   | 10            | 5.5            |

**Table 2: Distribution based on Diabetic profile of study participants (N=180)**

| Diabetic Profile                      |                                  | Frequency(n) | Percentage (%) |
|---------------------------------------|----------------------------------|--------------|----------------|
| Duration of Diabetes(in years)        | 6 months to <1year               | 34           | 18.8           |
|                                       | 1 to <3 Years                    | 93           | 51.9           |
|                                       | 3 to <5 Years                    | 34           | 18.8           |
|                                       | $\geq 5$ Years                   | 19           | 10.5           |
| Treatment                             | OHA                              | 131          | 72.8           |
|                                       | Insulin                          | 14           | 7.8            |
|                                       | Both (OHA & Insulin)             | 35           | 19.4           |
| Frequency of monitoring blood glucose | Monthly Once                     | 23           | 12.8           |
|                                       | 3 Months Once                    | 61           | 33.9           |
|                                       | 6 Months Once                    | 43           | 23.9           |
|                                       | Yearly Once                      | 27           | 15             |
|                                       | Not monitoring until symptomatic | 26           | 14.4           |

Fig 1: Awareness about self -monitoring of blood glucose in study participants (N=180)

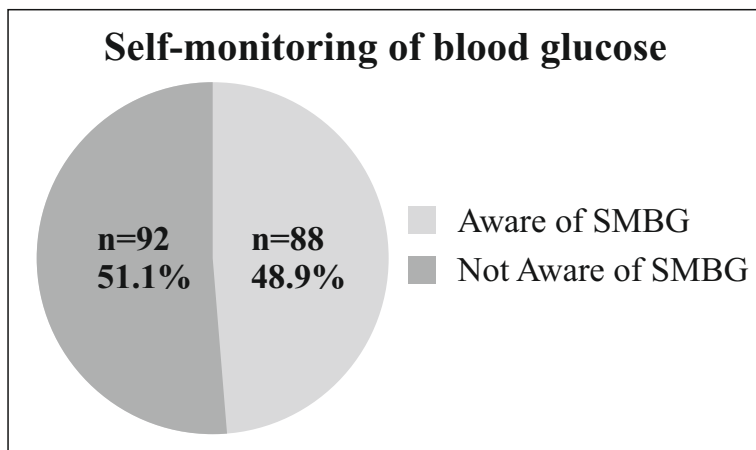


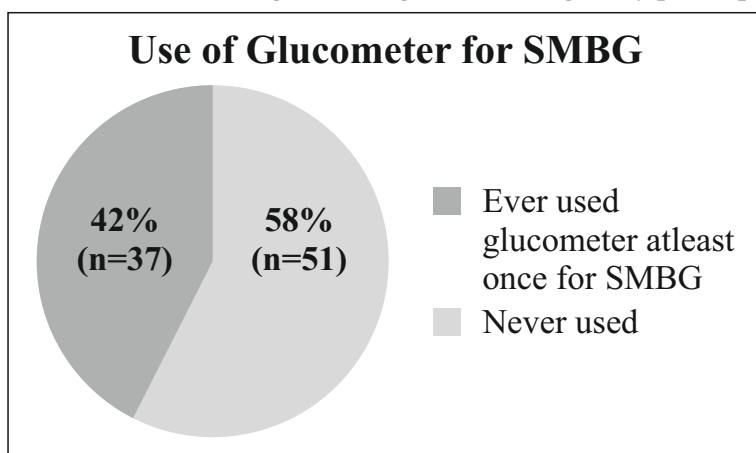
Table 3: Distribution of study participants based on Knowledge about SMBG (n = 88)

| Knowledge related to SMBG                        |                         | Frequency(n) | Percentage (%) |
|--------------------------------------------------|-------------------------|--------------|----------------|
| Source of information about SMBG                 | Healthcare professional | 46           | 52.6           |
|                                                  | Family/ Friends         | 17           | 19.2           |
|                                                  | Media                   | 17           | 19.2           |
|                                                  | Pharmacist              | 8            | 9              |
| Knowledge about how to use a glucometer for SMBG | Present                 | 56           | 64.1           |
|                                                  | Absent                  | 32           | 35.9           |
| Knowledge about benefits of SMBG                 | Present                 | 61           | 69.2           |
|                                                  | Absent                  | 27           | 30.8           |

Table 4: Attitude of study participants towards SMBG (n = 88)

| Attitude towards self-monitoring of blood glucose                          |         | Frequency (n) | Percentage (%) |
|----------------------------------------------------------------------------|---------|---------------|----------------|
| Fear of self-pricking                                                      | Present | 53            | 60.3           |
|                                                                            | Absent  | 35            | 39.7           |
| Self -monitoring is only for patients on insulin                           | Yes     | 39            | 44.9           |
|                                                                            | No      | 49            | 55.1           |
| Willingness to use a glucometer for SMBG if available at a subsidized cost | Yes     | 78            | 88.5           |
|                                                                            | No      | 10            | 11.5           |

Fig 2: Practice of self-monitoring of blood glucose among study participants (n=88)



**Table 5: Practice of self-monitoring of blood glucose among study participants (n=51)**

| Practice of self-monitoring of blood glucose        |                                    | Frequency (n) | Percentage (%) |
|-----------------------------------------------------|------------------------------------|---------------|----------------|
| Reasons for SMBG                                    | Randomly every 3 months to monitor | 12            | 23.5           |
|                                                     | As per doctors' advice             | 15            | 29.4           |
|                                                     | During illness                     | 15            | 29.4           |
|                                                     | During hypoglycemic symptoms       | 9             | 17.7           |
| Response to an abnormal blood glucose value in SMBG | Consult a doctor                   | 21            | 41.2           |
|                                                     | Modify the diet                    | 20            | 39.2           |
|                                                     | Self-adjust medication             | 6             | 11.8           |
|                                                     | No action                          | 4             | 7.8            |

**Table 6: Association between socio-demographic characteristics and awareness of SMBG among the study participants**

| Socio-Demographic variables      |                     | Awareness of SMBG |              | P value |
|----------------------------------|---------------------|-------------------|--------------|---------|
|                                  |                     | Present(n=88)     | Absent(n=92) |         |
| <b>Age (in years)</b>            | <30                 | 16 (18.2%)        | 1 (1.1%)     | <0.001* |
|                                  | 30-50               | 38 (43.2%)        | 24 (26.1%)   |         |
|                                  | 50-70               | 30 (34.1%)        | 58 (63%)     |         |
|                                  | >70                 | 4 (4.5%)          | 9 (9.8%)     |         |
| <b>Gender</b>                    | Male                | 46 (52.3%)        | 46 (50%)     | 0.768   |
|                                  | Female              | 42 (47.7%)        | 46 (50%)     |         |
| <b>Education</b>                 | Illiterate          | 6 (6.8%)          | 6 (6.6%)     | <0.001* |
|                                  | Up to primary       | 9 (10.2%)         | 27 (29.3%)   |         |
|                                  | Up to middle school | 25 (28.4%)        | 52 (56.5%)   |         |
|                                  | Graduate            | 48 (54.6%)        | 7 (7.6%)     |         |
| <b>Monthly income(in Rupees)</b> | <10,000             | 16 (18.1%)        | 12 (13%)     | 0.09    |
|                                  | 10,000- 30,000      | 38 (43.3%)        | 53 (57.6%)   |         |
|                                  | 30,000- 50,000      | 26 (29.5%)        | 25 (27.2%)   |         |
|                                  | >50,000             | 8 (9.1%)          | 2 (2.2%)     |         |

Note: Fisher's exact test (\*P value  $\leq 0.05$  is statistically significant)

On questioning about their attitude towards not considering using glucometer on a regular basis for self-monitoring, we found that 53 participants (60.3%) were afraid of self-pricking and 39 participants (44.9%) thought that self-monitoring using glucometer is only for patients on insulin therapy. Majority patients (n=78, 88.5%) expressed a positive attitude on using a blood glucose meter if it's available at subsidized cost (Table 4).

Among the 88 diabetic patients with awareness about SMBG, only 51 (57.9%) patients reported using glucometer at least once in their lifetime (Fig 2).

The common reasons for checking blood glucose were during illness (29.4%), as per doctors' advice when

required (29.4%). Majority patients (41.2%) consult a doctor or modify their diet (39.2%) when abnormal values were reported in the glucometer (Table 5).

Table 6 shows the association between awareness of SMBG with the socio-demographic variables of the study participants. Participants' awareness of SMBG was significantly associated with age ( $X^2$  24.64, df=3,  $p<0.001$ ) and also with their level of education ( $X^2$  45.35, df=3,  $p<0.001$ ).

### Discussion:

The current study assessed the socio-demographic variables, diabetic profile, awareness, knowledge, attitude and practices of Self-Monitoring of Blood Glucose among 180 type 2 diabetic patients. Majority

participants (48.9%) were in the age group between 50-70 years, reflecting a higher prevalence of Type 2 diabetes in that age group. The mean diabetes duration of 2.52 years is notably short and may not represent longer-term patient behaviour and practices. Participants had varied education levels. In almost half of them, the monthly income ranged between Rs.10000-30000 which may influence their access to SMBG devices.

In developed nations with robust healthcare systems, SMBG is widely practiced whereas in India it's limited<sup>12</sup>. In this study, only 48.9% of the study participants (n=88) were aware of self-monitoring of blood glucose, while 51.1% (n=92) were unaware of SMBG. Among those aware (n=88), 52.6% participants reported that their primary source of information on SMBG were healthcare professionals. Despite the awareness, 35.9% lacked practical knowledge as they did not know how to use a glucometer and 30.8% were unaware of the benefits of SMBG. These findings are comparable with results of a community based cross-sectional study by Krishnan. V. et al in Tamil Nadu<sup>11</sup>, where only 24.1% had adequate knowledge on SMBG and 47.5% learnt about it from physician. These results highlight the significant gap in diabetes self-care education.

On further analysis, we also found that there is significant association between age ( $X^2$  24.64, df=3,  $p<0.001$ ) and level of education ( $X^2$  45.35, df=3,  $p<0.001$ ) with the awareness of self-monitoring of blood glucose. Similar results have been observed in Indian studies by Krishnan. V. et al<sup>11</sup> and Mathur et al<sup>12</sup> where young individuals and people with high education level had a positive attitude towards self-care behaviour and diabetes awareness. The study carried out by Gupta et al<sup>13</sup> in rural areas of Punjab indicated the same effect on the diabetes self-management behaviour in Indians. A study done in urban Bengaluru by Dasappa et al<sup>14</sup> also reported that younger age and formal education significantly influenced adherence to diabetes self-care practices among diabetic patients.

In this study, we also found that 60.3% individuals reported fear of self-pricking which could deter the use of SMBG. Many studies have comparable findings suggesting anxiety associated with finger pricking impact glycemic control and hampers overall self-management<sup>15,16,17</sup>. In this study, 44.9% patients believed that self-monitoring using glucometer is only for patients on insulin therapy, reflecting misconceptions regarding the use of SMBG in those with oral drugs. But majority patients (88.5%) expressed willingness to use blood glucose meter if it's available at a subsidized rate. These findings are similar to a study done by Basu et al<sup>18</sup>, majority patients (82.4%) lacked access to glucometer and nearly half (48.3%) mentioned that cost of glucose strips as a barrier to glucose self-monitoring.

Among those with awareness, only 57.9% had ever used a glucometer which was often irregular. Many checked blood glucose levels only during illness (29.4%) or as per doctors' advice when required (29.4%). These findings suggest use of SMBG is symptom driven rather than proactive or preventive use<sup>4</sup>. When there are abnormal readings, most patients had either consulted a doctor (41.2%) or modified their diet (39.2%).

These findings suggest the need for targeted educational programs regarding self-monitoring of blood glucose use and benefits, especially to older and less educated diabetics<sup>19</sup>.

### Limitations:

Since this was a hospital-based cross-sectional study conducted at a single tertiary care centre, the findings may not be fully representative of the general population. Consecutive non-random sampling may have introduced selection bias. As the sample size was calculated primarily based on SMBG awareness, the study may have had limited statistical power for secondary outcomes such as knowledge, attitude, practices, and subgroup associations. Although the questionnaire was pretested, formal reliability and validity assessments were not performed. SMBG practices were self-reported without objective

verification, which may have introduced recall and social desirability bias. In addition, multivariate analysis was not performed.

### **Conclusions:**

This study reveals significant gap in awareness, and practice of self-monitoring of blood glucose among type 2 diabetic patients. The socio-demographic factors, especially age and education level affects the awareness on SMBG. Healthcare providers should integrate structured, culturally tailored SMBG education into routine NCD clinic visits, with particular attention to older and less-educated patients who showed significantly lower awareness. Education should specifically address the correct use of glucometers and the relevance of SMBG for patients on oral anti-diabetic drugs, as nearly 45% held misconceptions that SMBG is only for insulin users<sup>20</sup>. Addressing misconceptions about SMBG through counselling should be an integral part of each clinical consultation. Given that 88.5% of aware patients expressed willingness to use glucometers if subsidized, policy efforts to reduce the cost of glucose test strips and devices may improve uptake; however, this must be coupled with training, follow-up support, and logistical access to ensure willingness translates into actual practice<sup>21,22</sup>.

### **Recommendations:**

To address these challenges effectively, it is necessary to strengthen patient education tailored to diverse populations and policy initiatives to increase the affordability and accessibility of SMBG devices.

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## Pilot implementation of Entrustable Professional Activities (EPAs) for competency-based assessment in undergraduate medical education in Community Medicine

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### Abstract:

**Introduction:** By directly observing real-world professional tasks, Entrustable Professional Activities (EPAs) make competency-based assessment possible. There is very less structured use of EPAs in undergraduate community medicine. The study's objectives were to develop, validate and pilot test an EPA module for Community Medicine among undergraduate students. **Methods:** Over the course of five months, single-center prospective interventional pilot research was carried out at the Punjab Institute of Medical Sciences' Department of Community Medicine in Jalandhar. Experts developed an EPA module titled "Assessment of nutritional status in a 3-year-old child," which was which had milestones in the emotional, cognitive, and psychomotor domains. The Item-Content Validity Index (I-CVI) and Scale-Content Validity Index (S-CVI) were evaluated. Direct Observation of Procedural Skills with entrustment levels was used to evaluate thirty Phase III Part I MBBS students. Feedback from students and faculty was obtained. **Results:** The EPA module showed high content validity, with I-CVI values ranging from 0.86 to 1.00 and an overall S-CVI of 0.94. Most students achieved entrustment level  $\geq 3$  for height (86.7%), weight (83.3%), MUAC measurement (73.3%), informed consent (80.0%), and communication skills (76.7%). Clinical judgement demonstrated lower entrustment, with 66.7% achieving Level  $\geq 3$  and 20.0% reaching Level 4. Student satisfaction rate was 86.7%, while all faculty expressed satisfaction. EPA feasibility was reported by 83.3% of students and 85.7% of faculty. Key challenges included time constraints, assessor calibration, and learner orientation. **Conclusion:** The EPA module was found to have strong validity, high satisfaction and feasibility among both students and faculty.

**Keywords:** Medical Education; Clinical Competence; Community Medicine; Undergraduate Medical Education; Feasibility; Competency-Based Education

### Introduction:

Medical education has increasingly shifted from traditional time-based training to competency-based medical education (CBME) due to concerns that traditional curriculum and end-point tests do not consistently ensure graduates' readiness for professional

practice. CBME strongly emphasizes clearly stated objectives and the alignment of teaching, learning, and assessment with those skills in order to meet the needs of patients and society.<sup>[1]</sup> Van van Vleuten and Schuwirth emphasized that evaluating professional competence needs variety of assessments techniques, repeated

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observations, and professional judgment in a variety of contexts and times.<sup>[2]</sup> Conventional undergraduate tests focus more on information or simulated performance and may not accurately represent students' real skills in the real world. Workplace-based assessment (WBA) was developed to close this gap, but its instructional value is often compromised by insufficient feedback, checklist-driven methods, and restricted observation.<sup>[3]</sup>

The idea of programmatic assessment, which aggregates several low-stakes student assessments throughout time to promote learning and justifiable progression decisions, has been put up to improve CBME assessment.<sup>[4]</sup> Entrustable Professional Activities (EPAs) have become a viable method for operationalizing CBME within this framework. EPAs are professional work units that include many competences and result in an entrustment judgment on the degree of supervision needed for safe performance.<sup>[5]</sup>

Although EPAs were first designed for postgraduate training, their usage in undergraduate medical education (UGME) has grown dramatically. International literature has demonstrated successful implementation of EPAs in undergraduate and postgraduate medical education across multiple disciplines, with studies reporting improved authenticity of assessment, structured feedback, learner engagement, and integration of cognitive, psychomotor, and professional domains into a single assessment framework.<sup>[6]</sup> Previous Indian literature has also highlighted the educational value of EPAs in strengthening workplace-based assessment and promoting progressive entrustment within CBME frameworks.<sup>[7]</sup> However, most published work has focused either on postgraduate training or conceptual discussions, while structured implementation studies in undergraduate Community Medicine remain limited.

In Community Medicine, EPAs offer a promising strategy to assess authentic community-based professional activities through direct observation and structured entrustment decisions. The present study contributes to existing literature by developing and validating a context-specific EPA module for

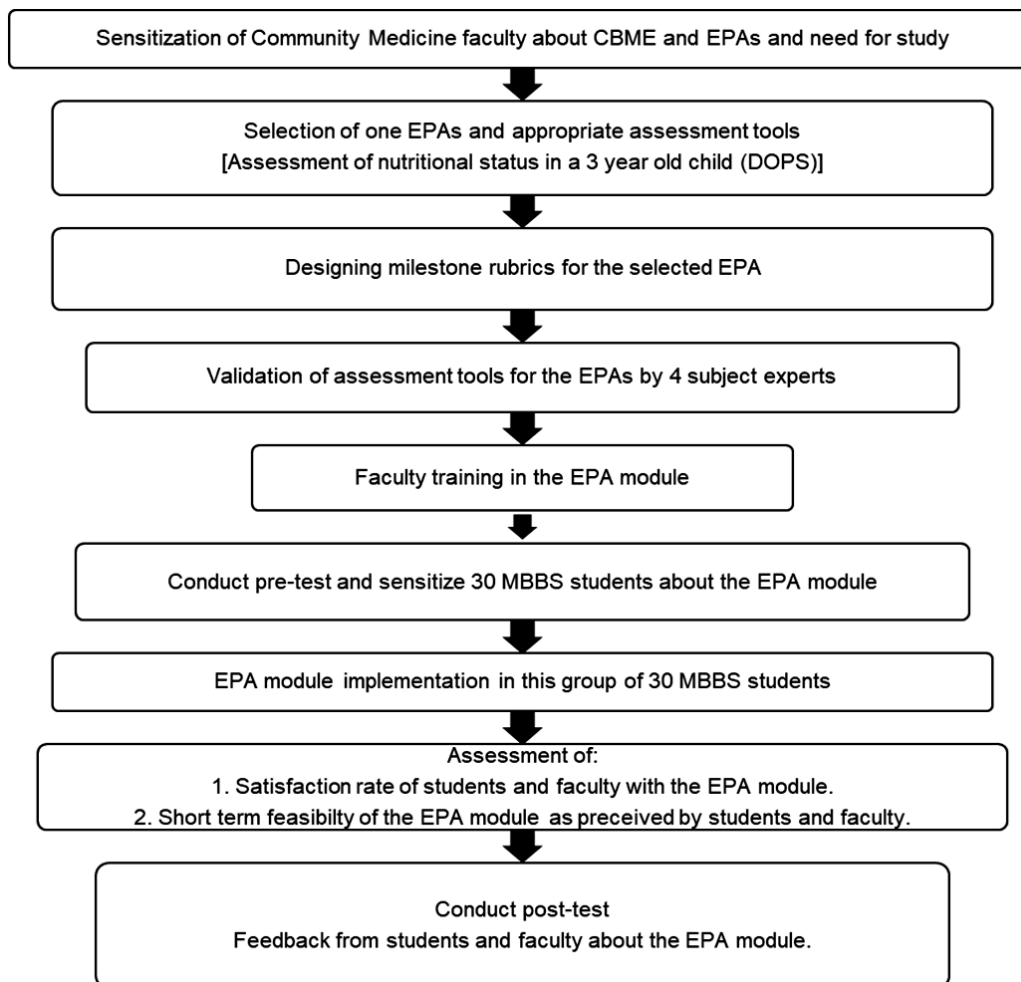
undergraduate Community Medicine and demonstrating its feasibility, acceptability, and educational utility within routine undergraduate teaching settings. The objectives of the study were to 1) develop and validate a milestone-based EPA module for assessment of nutritional status in a 3-year-old child among undergraduate medical students; 2) to assess student performance using entrustment-based assessment levels during pilot implementation of the EPA module; 3) to evaluate the satisfaction and perceived feasibility of the EPA module among students and faculty members; and to 4) identify challenges and suggestions related to the implementation of EPA-based assessment in undergraduate Community Medicine.

### Material and Methods:

The present study was conducted as a single-center, prospective, interventional pilot study from September 2025 to January 2026, in the Department of Community Medicine at Punjab Institute of Medical Sciences, Jalandhar. The study population comprised a small batch of 30 Phase 3 Part 1 MBBS students attending routine clinical posting in the department. Students were included in the study after obtaining written informed consent. Participation in the study and submission of feedback were entirely voluntary. Students were informed that their decision to participate or decline would not influence their academic evaluation, internal assessment, attendance, or relationship with faculty members in any manner. Community Medicine faculty members were involved in the implementation and assessment of the module. Students who failed to complete the EPA module were excluded from the study (Figure 1).

A structured method was used to develop the chosen Entrustable Professional Activity (EPA). A group of four subject matter experts directed the module's development. Benchmark levels for milestones were established along with specific learning objectives. The development of the EPA module was based on the framework proposed by Srivastava et al<sup>[7]</sup>, which served as the conceptual foundation and inspiration for the

**Figure 1. Study methodology flowchart**



design and implementation of the module. Both the frequency of assessments and the environment in which they would take place were decided. The level of student performance was then evaluated and categorized using a milestone-based rubric. To ensure appropriateness and validity of the rubric, it was validated both internally and externally by two internal and two external experts.

For evaluating an EPA pertaining to measuring and interpreting a 3-year-old child's mid-upper arm circumference (MUAC), we developed a milestone-based rubric (Annexure). It describes five levels of entrustment that reflect students' increasing competency development, from knowledge only (observation) to independent performance and the capacity to instruct others. Level 3 or above was considered indicative of acceptable supervised performance, as this level reflects the ability to perform the activity with indirect or

decreasing supervision. Levels 4 and 5 represented progresses toward independent performance and the ability to supervise or teach others. The rubric assesses a number of areas, such as communication with parents, clinical judgment, getting informed consent, and comprehension of anthropometric measurements (weight, height, and MUAC). The assessment plan was one assessment per student for 30 students, resulting in a total of 30 assessments. As this was a pilot implementation study, the EPA assessment was intended to evaluate feasibility, acceptability, and initial entrustment patterns rather than to provide formal summative certification of competence in the students. Therefore, one structured workplace-based observation was conducted per student using a milestone-based rubric. Data were collected using a pre-designed semi-structured study feedback questionnaire It included a

milestone-based assessment table with five levels of competency covering areas such as anthropometric measurements, informed consent, clinical judgement, and communication skills. The form also collects structured feedback from both students and faculty regarding satisfaction with the EPA assessment, its feasibility, and suggestions for improvement using yes/no responses and a Likert scale.

Descriptive analysis was done on the feedback responses on Likert scale and a thematic analysis was carried out for open ended questions after identifying recurring themes or patterns in qualitative feedback (open-ended questionnaire responses).

Informed consent was taken from all study participants before the start of the study. Ethical Approval was obtained on 29/11/2025 from Institutional Ethics Committee (IEC) vide letter no ECR/1413/Inst/PB/2020/RR-25 before study commencement.

## Results:

### Validation of EPA module

The teaching–learning methods comprised case presentation and small-group discussion, followed by Direct Observation of Procedural Skills (DOPS) for workplace-based assessment, as specified in the study

proforma. The EPA module underwent a structured validation process during the development stage. Four subject experts were involved to assess both the internal and external validity of the module. In addition, all faculty members of the department evaluated the EPA module across six predefined milestones encompassing the cognitive, psychomotor, and affective domains. The faculty reviewed the module for its relevance, clarity, and representativeness of the milestones<sup>[8]</sup>, which included indications and anatomical landmarks for height, weight, and MUAC measurement, obtaining informed consent, clinical judgement, and communication skills. The level of agreement among the faculty was quantified using the Item Content Validity Index (I-CVI) and Scale Content Validity Index (S-CVI). Milestone-wise agreement among the seven faculty members demonstrated strong content validity, with I-CVI values for individual milestones ranging from 0.86 to 1.00 (Figure 2). The overall S-CVI for the EPA module was calculated to be 0.94, indicating a high level of agreement regarding the content validity of the module. This pattern indicated that the EPA content was perceived as highly relevant and appropriate, with relatively greater scope for refinement in MUAC landmarking and clinical judgement descriptors.

**Figure 2. Content validity of the EPA module components**

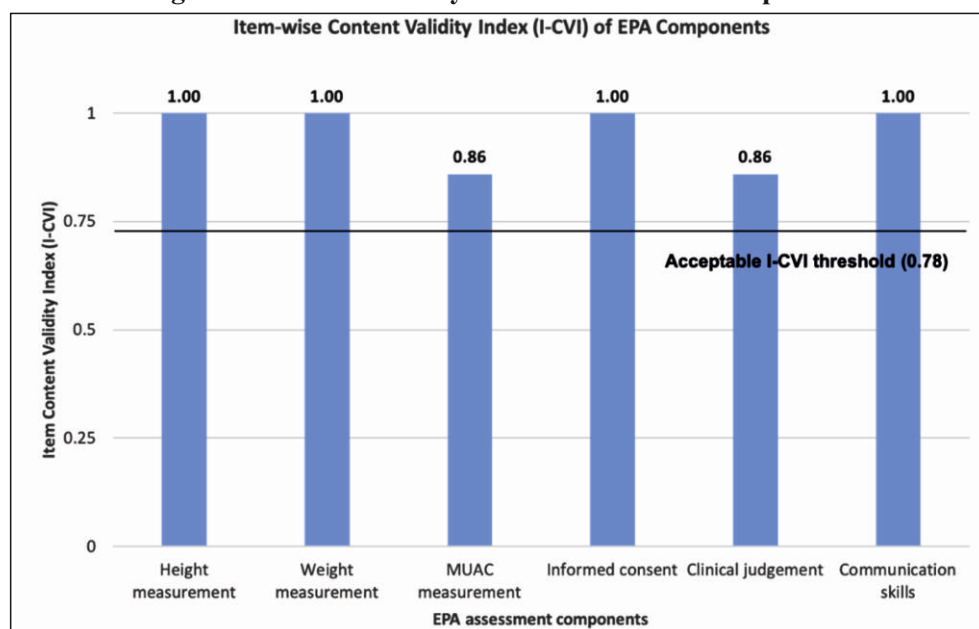
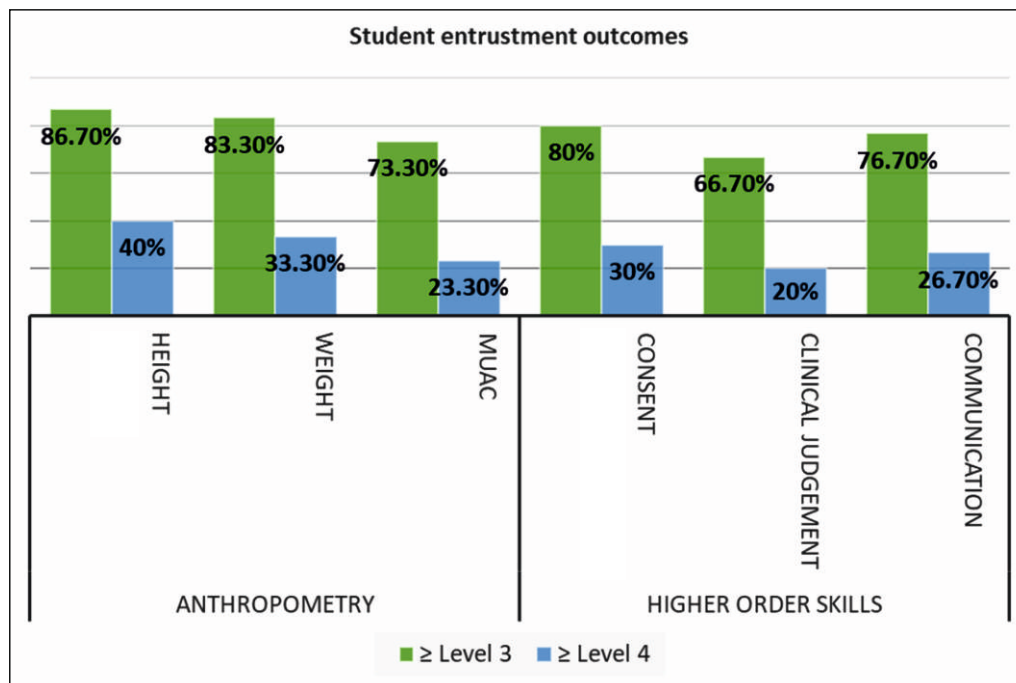


Figure 3. Student performance assessed using the EPA module Table 1



### Student performance

Student performance was recorded across five entrustment levels for each of the six milestones. Results were summarized as proportions achieving Level 3 or above (can perform with decreasing supervision), and Level 4 (independent), in keeping with entrustment-based reporting conventions (Figure 3). The distribution of entrustment levels across different competency domains showed that most students achieved Level 3 or Level 4 performance in the EPA assessment. For height measurement, 46.7% students achieved Level 3 and 40.0% achieved Level 4, while only 13.3% remained at Level 2. Similarly, for weight measurement, half of the students (50.0%) achieved Level 3 and 33.3% achieved Level 4. MUAC assessment demonstrated comparatively lower entrustment, with 26.7% students at Level 2, 50.0% at Level 3, and 23.3% at Level 4. In the informed consent domain, 50.0% students achieved Level 3 and 30.0% achieved Level 4. Clinical judgement showed relatively lower performance compared to procedural domains, with 40.0% students each at Levels 2 and 3, while only 20.0% achieved Level 4. Communication skills demonstrated moderate entrustment progression, with 50.0% students achieving

Level 3 and 26.7% achieving Level 4. Overall, procedural and anthropometric domains showed higher entrustment levels compared to higher-order domains such as clinical judgement and communication skills. Overall, the entrustment profile suggested that while most students reached supervised performance for core anthropometry steps, fewer reached higher entrustment in clinical reasoning and counselling.

### Satisfaction and feasibility among students and faculty

A majority of students reported satisfaction with the EPA-based assessment, with 26 out of 30 students (86.7%) indicating that they were satisfied. Among these, 24 students reported being “very satisfied,” while 2 reported being “satisfied.” Four students (13.3%) expressed dissatisfaction with the assessment process. The dissatisfaction reported by these students appeared to be related to logistical and transitional factors, including limited time during assessments, lack of initial orientation to the EPA framework, and anxiety associated with direct observation during skill assessment.

Faculty feedback was also obtained to evaluate satisfaction with the EPA-based procedural assessment.

All faculty members expressed satisfaction with the EPA structure, and most reported that the framework provided a clearer basis for observation and feedback during assessment. Among the seven faculty members, six (85.7%) reported being “very satisfied,” while one (14.3%) reported being “satisfied.”

Most students perceived the EPA module to be feasible, with 25 out of 30 students (83.3%) responding positively. Similarly, six out of seven faculty members (85.7%) considered the EPA-based assessment to be feasible.

### Thematic analysis of challenges in the implementation of EPAs

Qualitative feedback obtained from the open-ended responses of students and faculty regarding the EPA module was analysed using thematic content analysis (Table 1). The suggestions provided by students for improving the EPA module are presented in Table 2, while the suggestions provided by faculty members are summarised in Table 3.

**Table 1 : Thematic Analysis of Challenges in The Implementation of EPAs**

| Theme                                                | Description                                                                                                                                                                                                                                                                         | Illustrative quotes                                                                                                                                                                                                                                                                     |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Time constraints and operational feasibility         | Both students and faculty perceived EPA-based assessment as more time-intensive than conventional methods. Direct observation, documentation of entrustment levels, and provision of feedback were challenging within routine schedules, especially in large undergraduate batches. | <p>“Direct observation and feedback take more time than routine practical assessment, especially when many students are posted at the same time.” (Faculty)</p> <p>“Sometimes the observation felt rushed because of time constraints, which affected detailed feedback.” (Student)</p> |
| Need for assessor calibration and consistency        | Faculty highlighted variability in interpreting entrustment levels, particularly for higher-order domains such as clinical judgement and communication. The need for calibration and shared understanding among assessors was emphasized to reduce subjectivity.                    | <p>“Different faculty may interpret the same performance differently unless we have common benchmarks.” (Faculty)</p> <p>“Clear examples of what each level means would help in giving uniform scores.” (Faculty)</p>                                                                   |
| Learner orientation and assessment-related anxiety   | Students reported initial unfamiliarity with the EPA framework and entrustment levels, leading to uncertainty and anxiety during direct observation. Orientation and transparency were suggested to improve acceptance and confidence.                                              | <p>“At first, it was not very clear what was expected at each level of assessment.” (Student)</p> <p>“If we are explained beforehand how we will be assessed, it will reduce anxiety during observation.” (Student)</p>                                                                 |
| Need for clearer descriptors and behavioural anchors | Both students and faculty recommended refinement of the EPA tool through explicit behavioural descriptors and anchors. Clearer rubrics were perceived to enhance objectivity, guide learning, and improve feedback quality.                                                         | <p>“If specific actions are mentioned for each level, it will be easier to decide the entrustment level.” (Faculty)</p> <p>“Clear points on what we should do correctly would help us improve in the next assessment.” (Student)</p>                                                    |

**Table 2 : Thematic Analysis of Suggestions by Students for Improvement of The EPA Module**

| Stakeholder group | Theme                                                    | Description / Interpretation                                                                                                                                                  | Illustrative quotes                                                                                                                                                             |
|-------------------|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Students          | Need for prior orientation and clarity of expectations   | Students felt that clearer explanation of the EPA framework, entrustment levels, and assessment expectations before implementation would improve confidence and preparedness. | “If we are told clearly what is expected at each level beforehand, it will be easier to perform.”<br>“A short orientation before assessment will reduce confusion and anxiety.” |
| Students          | More opportunities for practice and formative assessment | Students suggested that repeated formative EPA encounters before summative judgement would enhance skill acquisition, particularly for MUAC measurement and counselling.      | “If we get more chances to practice with feedback, we can improve before final assessment.”                                                                                     |
| Students          | Detailed and actionable feedback                         | Students emphasized the need for specific feedback linked to performance and entrustment levels, rather than general comments.                                                | “Feedback should tell us exactly where we went wrong and how to improve.”                                                                                                       |
| Students          | Adequate time allocation during assessment               | Students felt that rushed observation limited demonstration of skills and depth of feedback; protected time was suggested.                                                    | “Sometimes the assessment feels hurried; more time would help us perform better.”                                                                                               |

**Table 3 : Thematic Analysis of Suggestions by Faculty for Improvement of the EPA Module**

| Stakeholder group | Theme                                                       | Description / Interpretation                                                                                                                     | Illustrative quotes                                                                       |
|-------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Faculty           | Faculty training and calibration                            | Faculty highlighted the need for structured training and calibration to ensure consistent interpretation of entrustment levels across assessors. | “All faculty should have a common understanding of what each entrustment level means.”    |
| Faculty           | Refinement of milestone descriptors and entrustment anchors | Faculty recommended clearer behavioural descriptors, especially for higher-order domains such as clinical judgement and communication.           | “Clear behavioural anchors will reduce subjectivity while deciding entrustment levels.”   |
| Faculty           | Streamlining documentation and assessment workflow          | Faculty suggested simplifying assessment forms or documentation to reduce workload while maintaining assessment quality.                         | “The tool can be made more concise so that documentation does not become time-consuming.” |
| Faculty           | Integration of EPAs into routine teaching and assessment    | Faculty recommended embedding EPAs within regular practical sessions or internal assessments for sustainability.                                 | “EPAs should be part of routine practical teaching rather than an additional activity.”   |

## Discussion:

The findings of our pilot study are particularly relevant in the context of the global and national shift from traditional competency frameworks toward entrustment-based assessment, which aims to bridge the gap between theoretical competence and real-world clinical performance. Dhaliwal et al. emphasized that conventional competency-based approaches often fail to ensure integrated, workplace-ready performance, necessitating tools such as EPAs that assess observable professional activities across multiple domains simultaneously.<sup>[9]</sup> The current study operationalized this principle by embedding cognitive, psychomotor, and affective domains within a single EPA and evaluating students using DOPS-based entrustment levels, aligning well with the conceptual framework proposed by Dhaliwal and colleagues.<sup>[9]</sup>

The thorough validation procedure, which included departmental faculty and subject matter experts, was one of the study's main advantages. Excellent overall content validity was indicated by the Scale-Content Validity Index (S-CVI) of 0.94 and the Item-Content Validity Index (I-CVI) ranging from 0.86 to 1.00. Similar results have been documented in both Indian and foreign literature.<sup>[10]</sup> Shrivastava et al., in their community medicine postgraduate EPA study, reported an S-CVI of 1.00 for Mini-CEX and CBD and 0.87 for DOPS, highlighting similarly high levels of expert agreement while noting slightly lower scores for procedural components.<sup>[11]</sup> These results are supported by the slightly lower I-CVI values found in the current study for MUAC measurement (0.86) and clinical judgment (0.86), which indicate that procedural precision and higher-order reasoning are consistently more difficult to operationalize and standardize across assessors. Additionally, Gummesson et al. noted that although EPAs are generally regarded as pertinent and significant, scope definition and descriptor clarity frequently need iterative improvement during validation.<sup>[6]</sup>

Patra highlighted that EPAs are particularly valuable because they assess integrated professional functioning, unlike traditional tools that isolate

knowledge or skill components.<sup>[12]</sup> Undergraduate students can be trusted to perform ethical and interpersonal tasks under supervision, as evidenced by the fact that 80.0% of students in the current study attained Level e"3 in informed consent and 76.7% in communication skills. But only 30.0% and 26.7%, respectively, attained Level 4, supporting Patra's<sup>[12]</sup> claim that EPAs are more appropriate for progressive entrustment than for pass-fail choices. This was further supported by Thaman et al, who suggested that EPAs function as a bridge between competencies and clinical practice by mapping multiple milestones onto a single professional task.<sup>[13]</sup> The present findings substantiate this claim, as students who performed well in procedural milestones did not necessarily demonstrate equivalent proficiency in judgement-based milestones, highlighting the discriminatory capacity of EPAs in identifying domain-specific learning needs.

High levels of acceptability were observed among both students and faculty. In the present study, 86.7% of students reported satisfaction with EPA-based assessment, with the majority being "very satisfied," while 100% of faculty expressed satisfaction, including 85.7% who were very satisfied. These findings are concordant with Shrivastava et al., who reported that postgraduate students perceived EPA-based assessment as task-specific and less subjective, and faculty valued the clarity provided by rubrics and milestones.<sup>[14]</sup> Begum et al. similarly noted that the use of descriptive rubrics alongside EPAs improved transparency, facilitated feedback, and encouraged learner reflection.<sup>[15]</sup>

Furthermore, 83.3% of students and 85.7% of faculty in our study rated the EPA module as feasible for assessment within existing infrastructure and medical education system. This is important, as undergraduate EPAs are often considered as logistically challenging due to the number of students in a batch. Shrivastava et al. have repeatedly highlighted that EPAs are more commonly implemented at the postgraduate level because of feasibility concerns. However, they suggested that EPAs can be successfully integrated at the undergraduate level if the module is context-specific and

is carefully designed.<sup>[14]</sup> Gummeson et al<sup>[6]</sup> also highlighted that feasibility improves when EPAs are well defined and aligned with curriculum outcomes, which were also the key design features of our module. The current study provides empirical support for this suggestion of Shrivastava by demonstrating high feasibility and satisfaction rates among students and faculty.

### **Limitations:**

#### **There are a few limitations of the present study:**

1. The study was conducted among 30 MBBS Phase III Part I students and 7 faculty assessors, which limits the statistical power and generalizability of the findings.
2. As the study participants were undergraduate students undergoing routine departmental postings, the possibility of response bias in feedback responses cannot be completely excluded despite assurances regarding voluntary participation, anonymity, and non-impact on academic evaluation.
3. As the study was carried out in a single medical institution, the findings may reflect local teaching–learning practices, faculty experience, and institutional culture.
4. The study assessed entrustment levels at a single point during pilot implementation. Progression of entrustment over time, retention of skills, and transition from supervised to independent performance could not be evaluated due to the absence of longitudinal assessment.
5. Student and faculty satisfaction and feasibility were measured using self-reported responses, which are susceptible to response bias
6. The study did not include a parallel comparison with traditional assessment approaches (e.g., checklist-based practical examination), limiting the ability to objectively determine whether EPA-based assessment resulted in superior performance or learning outcomes.

### **Conclusions:**

It is concluded that the developed EPA module for assessment of nutritional status in a 3-year-old child demonstrated high content validity, with I-CVI values ranging from 0.86 to 1.00 and an overall S-CVI of 0.94, indicating strong agreement among subject experts regarding the relevance, clarity, and representativeness of the defined milestones. Feedback from both students and faculty revealed a high level of satisfaction with the EPA-based assessment approach, reflecting its acceptability and perceived educational value among key stakeholders. The EPA module was also found to be feasible within the existing undergraduate teaching–learning and assessment framework, suggesting its potential for integration into routine formative assessment in Community Medicine. Overall, the findings indicate that EPA-based assessment offers a structured, authentic, and integrative approach for evaluating clinical competence among undergraduate medical students.

Thus, EPA-based assessment may be integrated into undergraduate medical education within the CBME framework to support authentic, workplace-based evaluation of clinical and public health competencies. Faculty development and orientation programs are essential to ensure consistent understanding of entrustment and effective implementation. Further multicentric and longitudinal studies are recommended to evaluate scalability, progression of entrustment, and long-term impact on competency development.

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## ANNEXURE-1

### Milestone Rubric for EPA for measuring and interpreting mid-upper arm circumference in a 3-year-old child

| Level 1:<br>Knowledge only, can observe                                                                    | Level 2:<br>Can do under direct supervision                               | Level 3:<br>Can do under loose supervision                                               | Level 4:<br>Can do independently                                                                   | Level 5:<br>Can teach others                                                                                    |
|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| <b>Has understanding of indications for weight measurement and relevant anatomical marking</b>             |                                                                           |                                                                                          |                                                                                                    |                                                                                                                 |
| Has clear knowledge about the indications and demonstrates the anatomical markings for weight measurement. | Has understanding of the technique of weight measurement.                 | Has understanding of the technique of weight measurement and its indications.            | Can independently perform weight measurements.                                                     | Can demonstrate weight measurement to juniors.                                                                  |
| <b>Has understanding of indications for height measurement and relevant anatomical marking</b>             |                                                                           |                                                                                          |                                                                                                    |                                                                                                                 |
| Has clear knowledge about the indications and demonstrates the anatomical markings for height measurement. | Has understanding of the technique of height measurement.                 | Has understanding of the technique of height measurement and its indications.            | Can independently perform height measurements.                                                     | Can demonstrate height measurement to juniors.                                                                  |
| <b>Has understanding of indications for MUAC measurement and relevant anatomical marking</b>               |                                                                           |                                                                                          |                                                                                                    |                                                                                                                 |
| Has clear knowledge about the indications and demonstrates the anatomical markings for MUAC measurement.   | Has understanding of the technique of MUAC measurement.                   | Has understanding of the technique of MUAC measurement and its indications.              | Can independently perform MUAC measurement.                                                        | Can demonstrate MUAC measurement to juniors.                                                                    |
| <b>Obtaining informed consent</b>                                                                          |                                                                           |                                                                                          |                                                                                                    |                                                                                                                 |
| Knows about the importance of obtaining informed consent prior to performing the procedure.                | Tells the parents and child about the procedure without explaining it.    | Explains the procedure to the child and the parents.                                     | Obtains written informed consent from the parents.                                                 | Can teach juniors about how to obtain written informed consent before the procedure.                            |
| <b>Clinical judgement</b>                                                                                  |                                                                           |                                                                                          |                                                                                                    |                                                                                                                 |
| No knowledge about the anthropometric measurements or its interpretation.                                  | Knows about anthropometric measurements but not about its interpretation. | Knows about anthropometric measurements and can interpret the findings.                  | Knows about anthropometric measurements, can interpret the findings and prepare a management plan. | Can teach others about the interpretation, correlation with history, management plan and preventive strategies. |
| <b>Communication skills</b>                                                                                |                                                                           |                                                                                          |                                                                                                    |                                                                                                                 |
| Tries to communicate with the parents                                                                      | Can communicate with the parents confidently                              | Has confidence in communicating with the parents and respond to their queries about MUAC | Can advise parents about the findings of anthropometric measurements.                              | Can communicate the findings to junior effectively.                                                             |

Assessment plan: 1 assessment per student.

30 students

30 students x 1 assessment = 30 assessments total.

# Unintentional Injuries and Its Characteristics Among Children Aged 0 to 14 Years in Field Practice Areas of the Community Medicine Department of a Tertiary Care Institute in South Gujarat : A Cross-sectional Study

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## Abstract:

**Introduction:** Childhood Unintentional Injuries (UI) are a major yet preventable public health concern, particularly in low- and middle-income countries. They contribute significantly to morbidity, and identifying associated risk factors is essential for prevention. **Objectives:** To estimate the proportion of UI in children. To document the characteristic, outcome and first-aid practices of UI in children. To assess the association of various socio-demographic factors and UI. **Methods:** A community-based descriptive cross-sectional study was conducted from April to August 2023 among 206 children using convenient sampling technique in the urban and rural field practice areas of Department of Community Medicine, Government Medical College, XYZ. Data were collected through house-to-house surveys using a pre-tested semi-structured questionnaire administered to caregivers. Descriptive statistics and chi-square/Fisher's exact tests were applied, with  $p < 0.05$  considered significant. **Results:** The proportion of UIs in the preceding six months was 26.7%, higher in rural (30%) than urban (22.1%) areas. Children aged 5–9 years were most affected (47.3%), with mean age  $7.27 \pm 3.32$  years. Significant associations were observed with age ( $p = 0.04$ ), education ( $p = 0.0125$ ), and parental marital status ( $p = 0.025$ ). Falls (41.8%) and burns (21.8%) were leading causes, with 56.4% occurring indoors. Traditional remedies like turmeric and toothpaste were common for first aid, while only 12.7% sought medical care. **Conclusion:** Childhood UIs are common and strongly influenced by sociodemographic factors. Promoting safer home environments, improving caregiver awareness, and providing first-aid training are essential to reduce this preventable burden.

**Keywords:** Children, First Aid, Community Health Services, Injuries Field practice area, Unintentional Injuries.

## Introduction:

An injury is described as “the physical damage that results when a human body is unexpectedly subjected to energy in amounts that go beyond the level of physiological tolerance –else wise the result of a lack of one or more vital elements, for example, oxygen” according to WHO report on child injury. Unintentional

injury (UI) as described by WHO that occur in the lack of predetermined aim, of which important causes are road traffic injuries, falls, drowning, burns, poisoning and animal bites.<sup>[1]</sup> According to CDC report on injury prevention & control, UI means which is not inflicted by intentional means. Injuries and poisonings that are characterized as unplanned or accidental are included,

|                                                                                     |                                                                                       |                                                                                                                                                                                                                                                                                                               |
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regardless of whether the harm was brought on by oneself or by another. Additionally, it covers injuries for which the emergency department's report had no indication of hostile intent.<sup>[2]</sup>

Childhood injury is a most important public health problem that demand immediate action. Injury and violence are important killer of children throughout the world, accountable for approximately 9,50,000 deaths in children and young people under the age of 18 years each year (WHO Global Burden of Disease: 2004 update). UI responsible for nearly 80% of these cases. Although everyone is at risk of injuries, but children are more vulnerable because of their age, gender, curiosity, and risktaking behaviour. Childhood is a susceptible age for injuries because of physical and mental boundaries in comparison to adult age groups. Deaths due to injuries have a huge effect on families and society, mainly in low- and middle-income countries (LMICs), where injury-related mortality among young children is 4 to 6 time greater than in high-income countries (HICs). Injuries and other NCD (Non-Communicable Disease) have a total contribution to the disease burden on children under 14 years of age in developing countries which is estimated to increase from 13% in the year 1990 to 22% in the year 2020.<sup>[1]</sup>

Identifying the factors related with UI may help minimize injuries. Several factors associated with UIs can be classified as- Child-related factors such as impulsiveness, experimenting, and lack of understanding on the judgment of speed. Environment-related factors such as poor housing set-up, inadequate storage places for hazardous substances, and lack of barriers to cooking/washing areas. These living circumstances are more prevalent in poor and middle-income nations like India. Other factors for example, parent's sociodemographic characteristics, age, education, and socioeconomic status have been associated with an increased risk of UI and their seriousness and accidents at home. A large number of such injuries occur in the home environment where children spend most of their time.<sup>[3]</sup>

Childhood unintentional injuries are largely preventable but continue to contribute substantially to morbidity among children in low- and middle-income countries. Data regarding injury patterns, associated socio-demographic factors, and first-aid practices in both urban and rural settings of XYZ are limited. Understanding these factors is important for planning targeted preventive interventions and improving caregiver awareness regarding child safety.

### **Objectives:**

- 1) To estimate the proportion of UI in children.
- 2) To document the characteristic, outcome and first-aid practices of UI in children.
- 3) To assess the association of various socio-demographic factors and UI.

### **Method:**

**Study design:** Community based descriptive cross sectional study

**Study settings:** Urban & rural field practice area of Community Medicine department, Government Medical College, Surat

**Urban-** UHTC, Althan (Indira-Nagar / Rasulabad / Azad-Nagar)

**Rural-** RHTC, Vanz (Aahir faliyu / Halpati vas / Hanuman faliyu of village Vanz) and (Halpati vas / Chhavisgara faliyu of Vaktana village)

**Study participants:** 0 to 14-year-old children population in study settings area of UHTC- Althan & RHTC-Vanz field practice area.

### **Inclusion criteria:**

- Children aged 0–14 years residing in the study area for at least 6 months whose parents/guardians provided written informed consent were included. Assent was not applicable as children were not interviewed directly.
- Children whose primary caregiver is mother/or any elder person of the household present at the time of data collection.

**Exclusion criteria:**

- Parents/guardians of children with physical or mental disabilities were excluded from the study.
- Parents/guardians who could not be contacted even after three home visits were excluded from the study.
- Parents/guardians of children who had sustained serious intentional injuries were excluded from the study.
- Children with any physical or mental disability were excluded from the study.

**Data collection period:** April 2023 to August 2023

**Sample size calculation:**

- The sample size was calculated using OpenEpi software at a 95% confidence level ( $\alpha = 0.05$ ) with 5% absolute precision based on the expected prevalence from previous studies. Taking prevalence of Unintentional Injuries (UI) in rural area 8.5 and in urban area 5.9, sample size comes out to be 120 for rural and 86 for urban area. So, total sample size was 206.<sup>[4]</sup>

**Sampling method:** Convenient sampling technique was used

**Data Collection:**

Mother/or any elder person of the household of 0 to 14 years old children residing in both field practice areas would be contacted by house to house visit and interviewed using pre-tested semi-structured questionnaire regarding Unintentional Injuries (UI). Caregivers were encouraged to recall injury events using temporal landmarks such as festivals, school events, or family occasions to improve recall accuracy. Injuries were classified as intentional or unintentional based on caregiver history during the interview. Cases involving assault, self-harm, or violence were excluded. If a child had multiple injury in past 6 month then information of most recent injury was obtained. If there is more than one child living in one house with our inclusion criteria then

only youngest child /or who had injury in last six month which required medical treatment of an OPD/indoor basis were included in study.

**Study tools:**

Pre-tested semi-structured questionnaire was used. The Questionnaire was divided into 2 Section. Section A focused on the child's and parent's socio-demographic characteristics. Section B focused on types, patterns, first-aid treatment and outcome of UI in children.

**Data entry and analysis:**

The obtained data was recorded in a printed format and there after entered in Microsoft Excel. After data cleaning, analysis of data was done using Microsoft Excel and IBM SPSS software version 23. The frequencies (n), percentage (%), arithmetic mean standard deviation (M-SD), range, mode was calculated within the context of descriptive statistics. The statistical test of chi-square and Fischer's Exact were used to compare categorical variables. Significant data was defined as a p-value of 0.05 or lower at 95% Confidence interval.

**Ethical consideration:**

The study was started after obtaining ethical clearance from the Institution Ethics Committee of Government medical College (Approval No GMCS/STU/ETHICS -3/Approval/5559/23). Informed written consent of the participant children's parent (mother/father/any elder person) was obtained after explaining the contents of the participant information sheet to them in a language they can understand and comprehend.

**Results:**

**Proportion of UIs:**

The overall proportion of unintentional injuries (UI) during the preceding six months was 26.7% (55/206). Among these, 19 cases (22.1%) were reported from the urban field practice area, while 36 cases (30.0%) were reported from the rural field practice area. As the present study was descriptive in nature, no statistical comparison between rural and urban areas was performed. Most

children experienced only one episode of injury during the recall period. Death due to UI was not observed in the study participants.

#### Sociodemographic characteristics of all participant children:

The majority of UI were reported in children aged 5–9 years (47.27%), with a mean age of  $7.27 \pm 3.32$  years. UI were slightly more common in boys (54.5%) than girls (45.45%). Over half of the children (56.36%) had primary education, while 20% were not attending school, though some were enrolled in Anganwadi. Most children (50.91%) had a birth order of two.

#### Sociodemographic characteristics of all participant children's parents:

Most children (92.8%) had married parents, with a few either divorced or separated. The mean ages of mothers and fathers were  $29.09 \pm 4.88$  years and  $30.34 \pm$

6.5 years, respectively. A majority of mothers (81.8%) had primary education, and over half (54.5%) were homemakers. Among fathers, 62% had primary education, and 74.54% were engaged in semiskilled work.

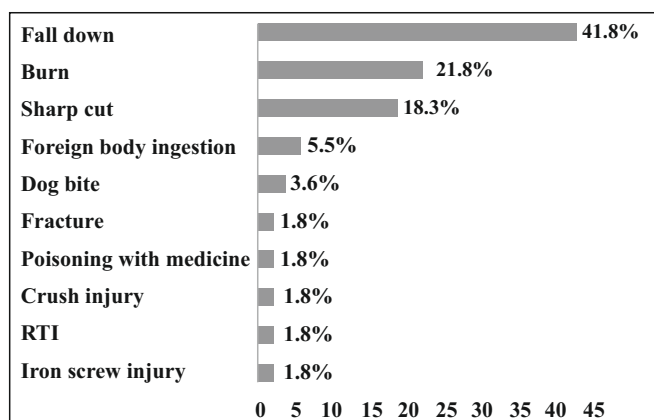
Table 1 shows the significant associations between children & their family characteristics and UI. Age group was significantly associated ( $p = 0.04$ ), with higher injury rates among children aged 5–9 years and 10–14 years. Educational status also showed a significant association ( $p = 0.05$ ), with most injuries occurring among children with primary education. Educational status showed a borderline significant association with unintentional injuries ( $p = 0.0125$ ), with most injuries occurring among children with primary+secondary education, which may be influenced by the younger age distribution of the study participants. Parental marital status was significantly linked to UI ( $p = 0.013$ ), with

**Table 1: Association of children and their parent's sociodemographic profile and occurrence of UIs. (n=206)**

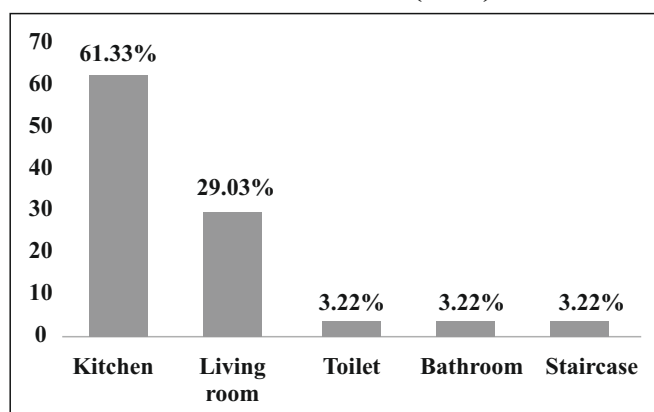
| Variable                  | Category                         | UI Present n (%) | UI Absent n (%) | $\chi^2$ / Fisher exact | p value |
|---------------------------|----------------------------------|------------------|-----------------|-------------------------|---------|
| Age group                 | 0–4                              | 12 (16.9)        | 59 (83.1)       | 6.525                   | 0.04    |
|                           | 5–9                              | 26 (28.9)        | 64 (71.1)       |                         |         |
|                           | 10–14                            | 17 (37.8)        | 28 (62.2)       |                         |         |
| Sex                       | Male                             | 30 (27.5)        | 79 (72.5)       | 0.08                    | 0.451   |
|                           | Female                           | 25 (25.8)        | 72 (74.2)       |                         |         |
| Education                 | Not going to school + Pre-school | 22 (19.6)        | 90 (80.4)       | 6.244                   | 0.0125  |
|                           | Primary + Secondary              | 33 (35.1)        | 61 (64.9)       |                         |         |
| Marital status of parents | Married                          | 51 (25.5)        | 149 (74.5)      | 5.0443                  | 0.0247  |
|                           | Divorced/separated/broken        | 04 (66.7)        | 02 (33.3)       |                         |         |
| Birth order               | $\leq 2$                         | 44 (28.0)        | 113 (72.0)      | 0.343                   | 0.558   |
|                           | $\geq 3$                         | 11 (22.4)        | 38 (77.6)       |                         |         |
| Number of siblings        | 0–1 sibling                      | 37 (25.7)        | 107 (74.3)      | 0.2466                  | 0.6195  |
|                           | $\geq 2$ sibling                 | 18 (29.0)        | 44 (71.0)       |                         |         |
| Age of sibling(n=110)     | $\leq 10$ year                   | 12 (19.7)        | 49 (80.3)       | 0.1267                  | 0.7219  |
|                           | $\geq 10$ year                   | 11 (22.4)        | 38 (77.6)       |                         |         |

\*In this Table 1 percentages are calculated row-wise.

**Graph 1: Distribution according to types of different UIs (n=55)**



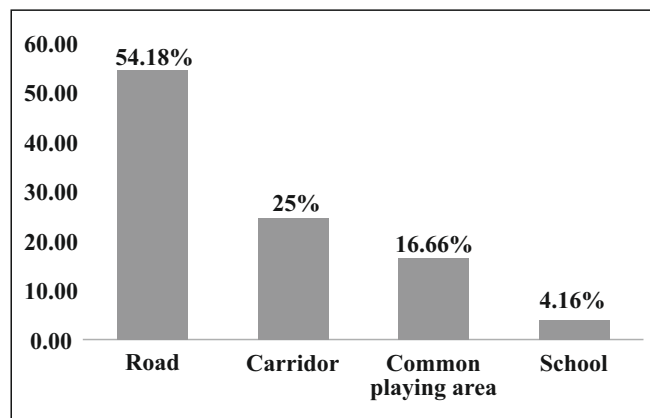
**Graph 2: Distribution of UI according to different indoor areas of house. (n=31)**



higher rates observed among children of divorced or separated parents. Statistically significant association was observed between parental marital status and unintentional injuries among children ( $p = 0.0247$ ). Most children with unintentional injuries belonged to married parents, this may be due to the higher proportion of married parents in the study population. No significant associations were noted for sex of the child, birth order, number of siblings and sibling age.

Graph 1 shows falls were the most frequent cause of UI, contributing to nearly half of the cases (41.8%). Burns (21.8%) and sharp cut injuries (18.3%) were also prominent, whereas foreign body ingestion (5.5%) and dog bites (3.6%) were comparatively less common. These findings emphasize that fall prevention and safe household practices should be key focus areas for child safety interventions.

**Graph 3: Distribution of UI according to different outdoor area of house (n=24)**



The majority of unintentional injuries (56.4%) occurred indoors, while 43.6% took place outdoors, indicating that children were more likely to get injured within the home environment.

Graph 2 showing that the kitchen emerged as the most common site for UI, accounting for nearly two-thirds of the cases (61.31%). This was followed by the living room (29.03%), while only a small proportion of injuries occurred in the toilet, bathroom, and staircase (3.22% each). These findings highlight the vulnerability of children in domestic spaces particularly in areas where cooking activities take place.

Graph 3 shows that over half of the children 13(54.18%) sustained injuries on the road side, followed by 6(25%) at corridor area, 4(16.66%) at common playing area and 1(4.16%) at school.

Table 2 showing that among the total injured children, 32.7% of children received turmeric application as first aid, while only 12.7% consulted a doctor. Mothers provided first aid in 60% of cases, and 65.45% received treatment within an hour. Most children (58.18%) resumed normal activities immediately; 5.45% took longer than a week. Temporary disability was seen in 5.45% of cases, with no permanent disability reported. Formal first aid training had not been received by any of the caregivers.

**Table 2: First aid treatment and outcome of UIs in children (n=55)**

| Variable                                                             | n, (%)     |
|----------------------------------------------------------------------|------------|
| <b>First aid treatment</b>                                           |            |
| Consult doctor                                                       | 07 (12.70) |
| Apply bandaged/ minor dressing                                       | 12 (21.80) |
| Apply ice-pack                                                       | 02 (03.60) |
| Apply turmeric                                                       | 18 (32.70) |
| Apply toothpaste                                                     | 09 (16.40) |
| Apply iodex                                                          | 02 (03.60) |
| Others (ointment, splintage, lukeman-hyati oil, cold water, nothing) | 05 (09.20) |
| <b>By whom first aid given</b>                                       |            |
| Mother                                                               | 33 (60.00) |
| Grandmother                                                          | 08 (14.50) |
| Neighbour                                                            | 02 (03.60) |
| Aunty                                                                | 04 (07.30) |
| Father                                                               | 05 (09.20) |
| Teacher                                                              | 01 (01.80) |
| Friend                                                               | 02 (03.60) |
| <b>Time of receiving actual treatment</b>                            |            |
| Within 1 hour                                                        | 36 (65.45) |
| After 1 hour                                                         | 19 (34.55) |
| <b>Routine activity resumed</b>                                      |            |
| Immediately                                                          | 32 (58.18) |
| 1-7 days                                                             | 20 (36.37) |
| >7 days                                                              | 03 (05.45) |
| <b>Any disability</b>                                                |            |
| None                                                                 | 00 (00.00) |
| Temporary                                                            | 03 (05.45) |
| Permanent                                                            | 00 (00.00) |
| <b>Received any training for first aid</b>                           |            |
| Yes                                                                  | 00 (00.00) |
| No                                                                   | 55 (100.0) |

## Discussion

The present study provides community-based evidence regarding the burden, pattern, and first-aid practices related to childhood unintentional injuries in both urban and rural field practice areas of Department of Community Medicine, GMC Surat. Although several studies on childhood injuries have been conducted in India, limited literature is available from this region incorporating both injury characteristics and caregiver responses to injuries.

Overall proportion of UI in our study during the last 6 months was 55 (26.6%). A study conducted by T Mahalakshmi (2011) in rural Puducherry reported a 1-year prevalence of unintentional injuries of 23% among children aged less than 14 years.<sup>[5]</sup> Similarly, Jagriti Bhatia et al. (2020) in Delhi reported a 1-year prevalence

of 29.3%.<sup>[6]</sup> Although the recall period differed from the present study, the prevalence estimates were within a comparable range. However, One ICMR funded study conducted in Ahmedabad city of District Gujarat by Viral R. Dave et al. (2021) where they found overall prevalence of UIs was 7.62 % which is in contrast to our study result which may be due to exclusion of minor injuries from the study and another reason the sociodemographic variables, environmental risk factors were also different in our study area compared to them.<sup>[4]</sup>

According to age group wise, we found in our study that children of 5-9 years (47.27 %) age group injured more followed by 10-14 years (30.92 %) and 0-4 years (21.81 %). The study conducted by Pant et al. (2015) in Nepal they also found higher UIs among 5-9 years age group.<sup>[7]</sup>

Our study has found that male children (54.5 %) were more affected than female children (45.5 %) which was similar to the results of other study conducted in rural area of West Bengal by Sitikantha Banerjee et al. (2016) which was community based cross sectional study.<sup>[8]</sup> Same result also found in one of the study conducted by Parmeswaran et al. (2017).<sup>[9]</sup> This might be because of the socialization processes, which lead male children to engage in risky behaviour than females, differences in aggressiveness and personality also.

On finding association between sociodemographic characteristic of children and being victim of UI, it was found that age group ( $p=0.04$ ) and education level ( $p=0.05$ ) were significantly associated as  $p\leq 0.05$ , while other characteristics like sex, birth order, no. of siblings, age of the siblings were not significantly associated. While the contrasting finding seen in study conducted by Prafulla Shriyan et al. (2014) in coastal Karnataka where they saw that number of the sibling was significantly associated with occurrence of UIs.<sup>[10]</sup> This difference may be due to difference in study population, cultural patterns and environmental factors difference in both study region. However statistically significant finding highlights that age group and level of education has significant impact on UIs, so it indicates that we should focus on developing age specific and educational preventive strategies.

Our study revealed that among the total UIs, Fall-related (41.8%) were highest followed by burn (21.8 %) and sharp cut injury (18.3 %). These findings were similar to another study conducted in India.<sup>[4,8]</sup> The high prevalence of fall related injuries attributed to several factors especially in rural areas. Environmental hazards such as uneven ground surfaces, lack of safety equipment and poor lighting may increase the risk of falls. Burn injuries, which constitute second highest percentage, may be due to common use of wooden chulha in rural areas for cooking and in urban slum area for water heating, as well as inadequate supervision of children around the fire sources.

The current study showed that majority of UIs occurred inside home of the children (56.4 %) and this

result similar with the study conducted by Prafulla Shriyan et al. (2014) in coastal Karnataka.<sup>[10]</sup> The high incidence of injuries occurring at home may be attributed different factors like lack of childproofing safety equipment like improper storage of hazardous materials/substance especially in rural area, lack of supervision in urban area especially in nuclear family where mother often engaged in household domestic activities.

Within inside area, majority of UIs occurred in the kitchen area (61.31%) followed by living room (29.03 %). However, Sudhir et al. (2014) and Netra G et al. (2017) reported in their study that courtyard and kitchen were the most common place for occurrence of domestic accidents.<sup>[11, 12]</sup> The reason for kitchen being the most common place for UI in our study may be because in our study area majority houses have no separate kitchen area (kitchen along with living room), use of wooden chulha for water heating, improper storage of knife and lack of supervision by parents when they work in kitchen.

Regarding first-aid treatment provided at the time of UI by caregivers, most of them practice application of turmeric paste followed by use of bandaged/minor dressing. Similar results were found in the study conducted by Netra G et al. (2017).<sup>[12]</sup> In our study, first-aid were provided by the mother in more than half of the children (60%) and time of receiving actual treatment (in case if required) after first aid was also within one hour in majority of children (65.45%). The reason may be that mothers were the primary caregiver who were present at home in majority of cases and they gain knowledge of first aid from their elder family members and previous experiences. The time of receiving actual treatment was within one hour which may be due to nearby availability of health facilities in our study areas. So, these both factors have positive effect in the outcome of UI.

In our study, when we asked caregivers if they had received any training for providing first-aid treatment in emergency, all of them said no. None of the caregiver had any form of formal training for first-aids. So, this indicate a gap in education and resources for caregiver that can be improved by implementing training program related to first-aid treatment.

# Limitation:

As the study was conducted in selected urban and rural field practice areas attached to a tertiary care institute, the findings may not be generalizable to all community settings. However, the study provides useful baseline information regarding childhood unintentional injuries in similar settings. Additionally, reliance on six-month recall of UIs may introduced recall bias, although efforts were made to ensure accuracy. Preferential inclusion of children with recent unintentional injuries in households with multiple eligible children may have introduced selection bias.

# Conclusion

The present study demonstrates that unintentional injuries are common among children, particularly among those aged 5–9 years. Significant associations were observed with age and parental marital status. Most injuries occurred indoors, especially in kitchen areas, and were frequently managed using traditional remedies rather than professional medical care. Lack of formal first-aid training among caregivers highlights the need for preventive interventions, caregiver education, and safer household environments to reduce childhood injuries.

Further, we should encourage child-safe home practices, especially in kitchens and play areas, and promote closer supervision of young children.

Provide basic first-aid training to caregivers through community health workers and increase awareness about when to seek medical help.

Use schools, Anganwadi, and local health platforms (Subcentre, Primary Health Centre) to educate both children and parents about injury prevention and safe behaviour.

# Declaration:

Conflict of interest: No

Funding: No

Use of AI: No

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## Prevalence and Determinants of Self-Medication among Elderly in an Urban Community of India: A Community-Based Cross-Sectional Study

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### Abstract:

**Introduction:** Self-medication, defined as the use of medicines without consultation with a qualified healthcare professional, is common among older adults and can pose significant health risks. **Objectives:** To determine the prevalence of self-medication among elderly individuals in an urban Indian community and to examine associated indications, medication types, and socio-demographic and personal factors influencing this practice. **Methods:** A community-based cross-sectional study was conducted from August 2021 to August 2022 in the urban field practice area of a tertiary care teaching hospital in Ahmedabad, Gujarat. A total of 700 adults aged >65 years were selected by simple random sampling. Data were collected through face-to-face interviews using a pre-tested semi-structured questionnaire. Descriptive statistics and multivariate logistic regression were applied, with  $p < 0.05$  considered statistically significant. **Results:** The prevalence of self-medication was 62.1%. Common indications were fever (71.5%), cold (66.9%), cough (62.8%), and musculoskeletal complaints (42.8%). Analgesics (41.8%) and antihypertensives (39.5%) were most commonly used. Independent predictors included age 65–79 years (AOR = 3.25; 95% CI: 2.05–5.14), female gender (AOR = 2.12; 95% CI: 1.45–3.10), illiteracy (AOR = 1.52; 95% CI: 1.10–2.10), living alone (AOR = 6.18; 95% CI: 1.84–20.8), and joint/extended family type (AOR = 1.87; 95% CI: 1.20–2.92). Habit status and BMI were also significantly associated. **Conclusion:** Self-medication is highly prevalent among the urban elderly and is influenced by socio-demographic and personal factors. Strengthening health literacy, regular medication review, and pharmacist-led education is essential to promote rational drug use.

**Keywords:** Elderly; Rational drug use; Self-medication; Urban population

### Introduction:

Self-medication is defined as the selection and use of medicines by individuals to treat self-recognized illnesses or symptoms without consultation with a qualified healthcare professional.<sup>[1,2]</sup> While responsible self-medication may play a limited role in managing minor ailments, inappropriate use poses substantial public health risks, including adverse drug reactions, drug–drug interactions, antimicrobial resistance, and delayed diagnosis of serious conditions.<sup>[3,4]</sup>

Consequently, irrational self-medication practices represent an important challenge to patient safety and rational medicine use globally.<sup>[5]</sup>

Older adults are particularly susceptible to the adverse consequences of unsupervised medication use.<sup>[6]</sup> Age-related physiological changes affecting pharmacokinetics and pharmacodynamics, coupled with a high prevalence of multimorbidity and polypharmacy, significantly increase the risk of medication-related complications.<sup>[7,8]</sup> Furthermore, the unsupervised

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continuation or modification of previously prescribed therapies for chronic conditions such as hypertension and diabetes mellitus, without periodic medical review, may lead to inadequate disease control and preventable adverse outcomes.<sup>[9]</sup>

Self-medication practices are especially common in low- and middle-income countries, where structural barriers such as limited healthcare access, financial constraints, long waiting times, and easy availability of over-the-counter medications promote unsupervised drug use.<sup>[10,11]</sup> In India, reported prevalence varies widely across studies due to differences in methodology, study populations, and operational definitions.<sup>[12,13]</sup> Factors such as unrestricted pharmacy access, reuse of old prescriptions, availability of leftover medicines, and reliance on informal sources of advice further contribute to the widespread practice.<sup>[14–16]</sup>

India is undergoing a rapid demographic transition characterized by a steadily increasing elderly population alongside a growing burden of chronic non-communicable diseases.<sup>[17]</sup> Despite this shift, community-based evidence focusing specifically on self-medication practices among the urban elderly remains limited. Understanding the magnitude and determinants of this behaviour is essential for designing targeted health education initiatives, strengthening pharmacist engagement, and informing policy measures aimed at promoting rational drug use among older adults.<sup>[18]</sup>

Therefore, the present study was undertaken to determine the prevalence of self-medication among elderly individuals residing in an urban Indian community and to assess the common indications, types of medications used, and socio-demographic and personal factors associated with this practice.

## Materials and Methods:

### Study Design and Setting

A community-based cross-sectional study was conducted from August 2021 to August 2022 in the urban field practice area attached to a tertiary care teaching hospital in Ahmedabad, Gujarat, India.

### Study Population

Elderly individuals aged  $\geq 65$  years who were permanent residents of the study area for at least one year were included. Individuals who were severely ill, cognitively impaired<sup>[19]</sup> as assessed by history of diagnosed cognitive disorder or inability to respond appropriately to the questionnaire, or unwilling to participate were excluded.

### Sample Size

Assuming a prevalence of 37% based on previous studies and meta-analyses reporting self-medication prevalence among elderly populations to be approximately 36%, with Indian studies showing a range of 36%–66%<sup>[12,20,21]</sup>, 95% confidence level, and 10% allowable error, the minimum required sample size was 681, rounded to 700 to account for non-response.

### Sampling Method

The urban field practice area was divided into five administrative units. The total sample size was equally allocated across these units. Eligible participants were selected using simple random sampling from household lists maintained by health workers.

### Operational Definition

Self-medication was defined as the use of any medication without consultation from a qualified healthcare professional for self-recognized illness within the past three months.

### Data Collection

Data were collected through face-to-face interviews using a pre-tested semi-structured questionnaire, translated into the local language (Gujarati), and back-translated to ensure validity and consistency. Information on socio-demographic characteristics, personal factors, indications, types of drugs, and reasons for self-medication was obtained. Height and weight were measured using standard instruments, and BMI was calculated according to WHO criteria.<sup>[22]</sup> Habit status was defined as current tobacco or alcohol use. Socioeconomic status was assessed using the Modified Kuppaswamy Scale (updated for 2021 income criteria).<sup>[23]</sup>

### Statistical Analysis

Data were entered into Microsoft Excel and analysed using the Statistical Package for the Social Sciences (SPSS) version 26.0 (institutional licensed version). Descriptive statistics summarized participant characteristics and self-medication patterns. Associations between self-medication and independent variables were assessed using Chi-square test. Variables significant at  $p < 0.05$  in bivariate analysis were included in multivariate logistic regression to identify independent predictors, expressed as adjusted odds ratios (AOR) with 95% confidence intervals (CI).

### Ethical Considerations

The study was approved by the Institutional Ethics Committee of B. J. Medical college, Ahmedabad (Ref no.- 166/2021). Verbal informed consent was obtained from all participants, and confidentiality was maintained.

### Results:

Among the 700 elderly participants included in the study, nearly two-thirds (62.1%) of participants reported self-medication. (Figure 1). Among those who practiced self-medication, the most commonly reported indications were fever (71.5%), cold (66.9%), cough (62.8%), and runny nose (56.8%), followed by musculoskeletal complaints such as aches and pains

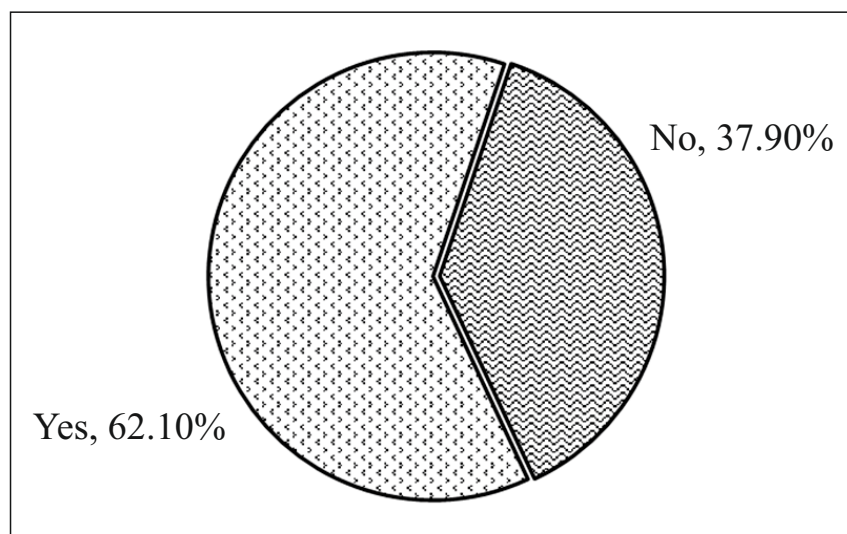
(42.8%) and headache (39.8%). Gastrointestinal and other indications were reported less frequently (Figure 2).

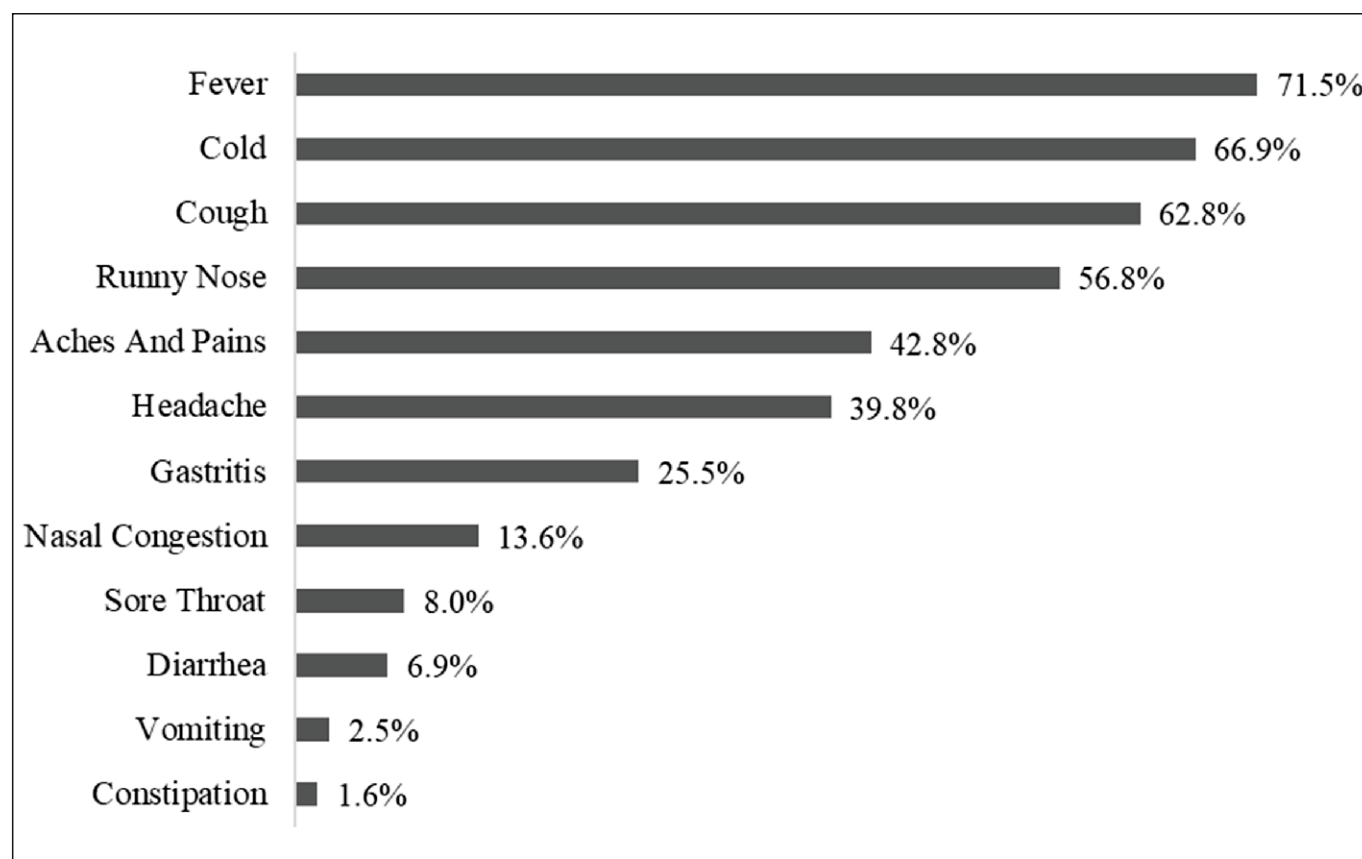
Consistent with these indications, the most commonly used medications were analgesics (41.8%) and antihypertensive drugs (39.5%), followed by antitussives (25.7%), antacids (24.1%), and hypoglycaemic agents (22.3%). Use of antibiotics (4.4%) and other medications was comparatively low (Figure 3).

Analysis of socio-demographic characteristics showed that self-medication was significantly more prevalent among participants aged 65–79 years compared with those aged  $\geq 80$  years ( $p < 0.0001$ ), among women compared with men ( $p < 0.0001$ ), and among illiterate participants compared with literate participants ( $p = 0.007$ ). No significant association was observed with occupational status. Family structure was significantly associated with self-medication, with higher prevalence among participants living in joint and extended families compared with nuclear families (Table 1).

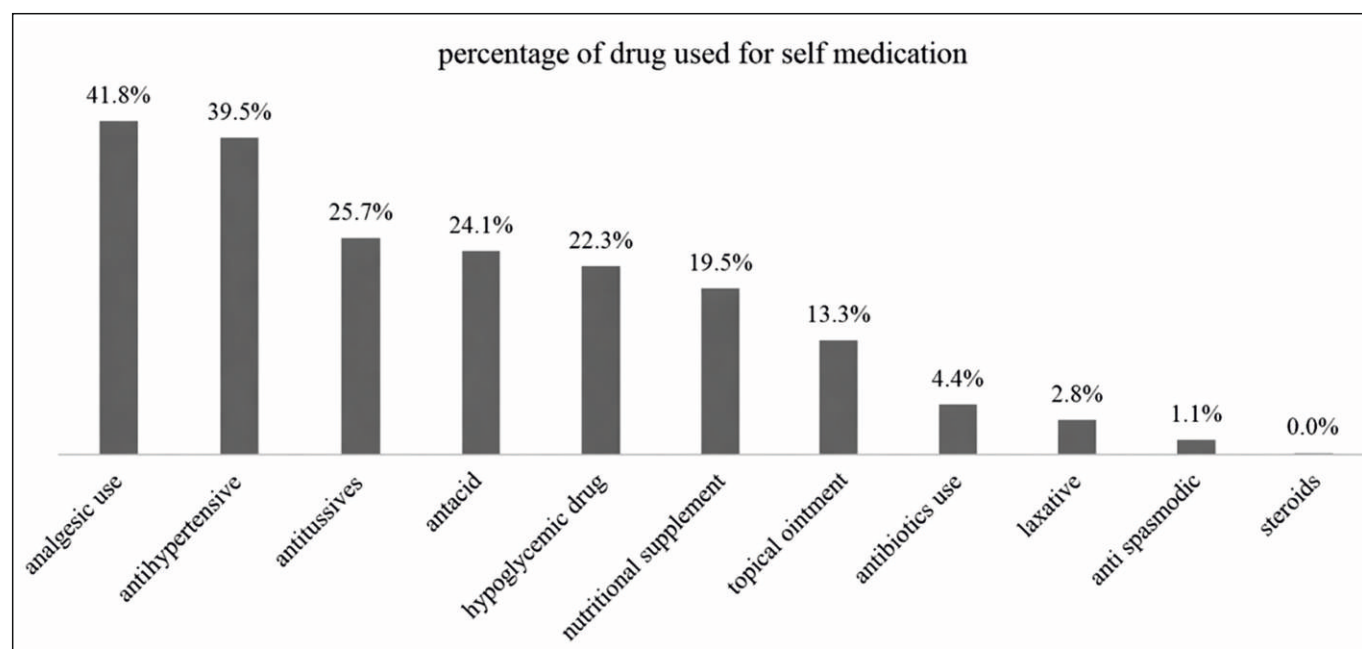
With respect to personal characteristics, self-medication prevalence differed significantly by living arrangement, with the highest prevalence among participants living alone, followed by those living with children, with spouse and children, and with spouse only

**Figure 1: Prevalence of self-medication (n=700)**



**Figure 2: Indications for self-medication in the geriatric population (n=435) \***

\*Multiple responses allowed

**Figure 3: Distribution of medications used for self-medication (n=435) \***

\*Multiple responses allowed

**Table 1: Association of socio-demographic characteristics with self-medication among elderly participants (n=700)**

| Characteristics    | Yes n (%)  | No n (%)   | Total n (%) | Test statistic ( $\chi^2$ value) | p value |
|--------------------|------------|------------|-------------|----------------------------------|---------|
| <b>Age</b>         |            |            |             |                                  |         |
| 65–79              | 400 (65.9) | 207 (34.1) | 607 (100.0) | $\chi^2 = 35.82$                 | <0.001* |
| ≥80                | 35 (37.6)  | 58 (62.4)  | 93 (100.0)  |                                  |         |
| <b>Gender</b>      |            |            |             |                                  |         |
| Male               | 114 (46.3) | 132 (53.7) | 246 (100.0) | $\chi^2 = 37.12$                 | <0.001* |
| Female             | 321 (70.7) | 133 (29.3) | 454 (100.0) |                                  |         |
| <b>Education</b>   |            |            |             |                                  |         |
| Illiterate         | 177 (68.6) | 81 (31.4)  | 258 (100.0) | $\chi^2 = 7.23$                  | 0.007*  |
| Literate           | 258 (58.4) | 184 (41.6) | 442 (100.0) |                                  |         |
| <b>Occupation</b>  |            |            |             |                                  |         |
| Working            | 78 (59.1)  | 54 (40.9)  | 132 (100.0) | $\chi^2 = 0.65$                  | 0.42    |
| Not working        | 357 (62.9) | 211 (37.1) | 568 (100.0) |                                  |         |
| <b>Family type</b> |            |            |             |                                  |         |
| Joint              | 287 (68.2) | 134 (31.8) | 421 (100.0) | $\chi^2 = 24.73$                 | <0.001* |
| Nuclear            | 132 (50.8) | 128 (49.2) | 260 (100.0) |                                  |         |
| Extended           | 16 (84.2)  | 3 (15.8)   | 19 (100.0)  |                                  |         |

\*Statistically significant at  $p < 0.05$

**Table 2: Association of personal characteristics with self-medication among elderly participants (n=700)**

| Characteristics                 | Yes n (%)  | No n (%)    | Total n (%)     | Test statistic ( $\chi^2$ value) | p value |
|---------------------------------|------------|-------------|-----------------|----------------------------------|---------|
| <b>Living arrangement</b>       |            |             |                 |                                  |         |
| Living single                   | 18 (94.7)  | 1 (5.3)     | 19 (100.0)      | $\chi^2 = 37.91$                 | <0.001* |
| Living with children            | 148 (70.1) | 63 (29.9)   | 211 (100.0)     |                                  |         |
| Living with a spouse            | 21 (32.8)  | 43 (67.2)   | 64 (100.0)      |                                  |         |
| Living with spouse and children | 248 (61.1) | 158 (38.9)  | 406 (100.0)     |                                  |         |
| <b>Dependency</b>               |            |             |                 |                                  |         |
| Dependent                       | 335 (61.8) | 207 (38.2)  | 542 (100.0)     | $\chi^2 = 0.08$                  | 0.78    |
| Independent                     | 100 (63.3) | 58 (36.7)   | 158 (100.0)     |                                  |         |
| <b>Habit (Tobacco/Alcohol)</b>  |            |             |                 |                                  |         |
| Yes 134 (55.8)                  | 106 (44.2) | 240 (100.0) | $\chi^2 = 6.63$ | 0.01*                            |         |
| No 301 (65.4)                   | 159 (34.6) | 460 (100.0) |                 |                                  |         |
| <b>BMI</b>                      |            |             |                 |                                  |         |
| Underweight                     | 81 (57.9)  | 59 (42.1)   | 140 (100.0)     | $\chi^2 = 10.91$                 | <0.01*  |
| Normal                          | 214 (68.8) | 97 (31.2)   | 311 (100.0)     |                                  |         |
| Overweight                      | 60 (54.5)  | 50 (45.5)   | 110 (100.0)     |                                  |         |
| Obese                           | 80 (57.6)  | 59 (42.4)   | 139 (100.0)     |                                  |         |

\*Statistically significant at  $p < 0.05$

**Table 3: Multivariate Logistic Regression Analysis of Factors Associated with Self-Medication Among Elderly Participants**

| Variable                            | Adjusted Odds Ratio (AOR) | 95% Confidence Interval (CI) | p value |
|-------------------------------------|---------------------------|------------------------------|---------|
| Age 65–79 vs ≥80                    | 3.25                      | 2.05–5.14                    | <0.001* |
| Female vs Male                      | 2.12                      | 1.45–3.10                    | <0.001* |
| Illiterate vs Literate              | 1.52                      | 1.10–2.10                    | 0.012*  |
| Living Alone vs With Spouse         | 6.18                      | 1.84–20.8                    | 0.003*  |
| Living with Children vs With Spouse | 2.11                      | 1.35–3.30                    | 0.001*  |
| Joint/Extended Family vs Nuclear    | 1.87                      | 1.20–2.92                    | 0.005*  |
| Habit (Tobacco/Alcohol)             | 0.72                      | 0.53–0.97                    | 0.031*  |
| BMI (Normal vs Others)              | 1.35                      | 1.01–1.80                    | 0.045*  |

\*Statistically significant at  $p < 0.05$

**Table 4: Reasons for self-medication among elderly participants (n=435) \***

| Reasons of self-medication                                 | Frequency | Percentage |
|------------------------------------------------------------|-----------|------------|
| Prior experience with drugs                                | 170       | 39.1%      |
| Minor health problem                                       | 251       | 57.7%      |
| Urgency of the problem                                     | 60        | 13.8%      |
| Advice from friends, family or neighbours                  | 78        | 17.9%      |
| Medicines present in the house                             | 70        | 16.1%      |
| Certainty of its safety                                    | 17        | 3.9%       |
| Hospital/Clinic far from home                              | 13        | 3.0%       |
| Easily available in drug stores                            | 28        | 6.4%       |
| No medical insurance and high cost of medical consultation | 29        | 6.7%       |
| Saving money                                               | 97        | 22.3%      |
| Inadequate time to attend the hospital                     | 15        | 3.4%       |

\*Multiple responses allowed

( $p < 0.001$ ). Habit status and body mass index were also significantly associated with self-medication practices, whereas dependency status showed no statistically significant association (Table 2).

Multivariate logistic regression was performed to identify independent predictors of self-medication among the elderly. Variables significant in bivariate analysis were included in the model (Table 3).

Reasons reported for self-medication were aligned with the observed indications and medication patterns. Minor health problems (57.7%) and prior experience with medicines (39.1%) were the most frequently cited reasons. Economic factors, availability of medicines at

home, social advice, urgency of illness, and accessibility of drug stores were also reported, while time constraints, perceived safety, and distance from healthcare facilities were less commonly cited (Table 4).

### Discussion:

Self-medication among elderly individuals represents an important public health concern due to age-related physiological changes, multimorbidity, and the high likelihood of polypharmacy, all of which increase susceptibility to adverse drug reactions and drug–drug interactions.<sup>[7,8]</sup> Additionally, inappropriate self-use of medications, particularly antibiotics, contributes to antimicrobial resistance and other preventable harms.<sup>[4,24]</sup>

Understanding the determinants and motivations underlying self-medication practices in this population is essential for designing targeted interventions that promote rational and safe medicine use.

In the present study, 62.1% of elderly participants residing in an urban community reported practicing self-medication. This prevalence is comparable to findings from North India (63%)<sup>[25]</sup> and Iran (76.2%).<sup>[26,27]</sup> Such variability across studies may reflect differences in sociodemographic characteristics, healthcare accessibility, regulatory enforcement regarding over-the-counter medication sales, and operational definitions of self-medication.

The reasons for self-medication identified in this study were multifactorial. Minor ailments, prior experience with medications, and convenience emerged as the most frequently cited reasons. These findings are consistent with previous literature indicating that symptom-driven self-medication is prevalent among older adults, particularly for conditions perceived as routine or recurrent.<sup>[14,28]</sup> While such practices may reduce the burden on healthcare facilities for minor conditions, they may also delay appropriate diagnosis and treatment when symptoms are misinterpreted.<sup>[3]</sup>

A significantly higher prevalence of self-medication was observed among women compared with men, consistent with earlier studies.<sup>[27,28]</sup> Lower educational status was also significantly associated with increased self-medication practices, possibly reflecting limited health literacy and inadequate awareness of medication-related risks.<sup>[29]</sup>

Polypharmacy and chronic disease burden were prominent contributors to self-medication practices. Many elderly individuals receiving long-term therapy for hypertension and diabetes may engage in unsupervised continuation or dose modification of medications, increasing the risk of adverse drug events and poor disease control.<sup>[8,9]</sup> These findings highlight the importance of regular medication review and strengthened follow-up mechanisms in primary care settings.

Healthcare system–related factors such as economic constraints, long waiting times, and difficulty accessing healthcare facilities have been widely documented as drivers of self-medication in low- and middle-income settings.<sup>[10,12]</sup> The frequent use of old prescriptions as a guide for medication use further indicates gaps in continuity of care and patient counselling.<sup>[30]</sup>

Pharmacists emerged as a key source of advice for elderly individuals engaging in self-medication. Their accessibility and community presence position them as critical stakeholders in promoting safe medication practices. Strengthening pharmacist-led education and awareness initiatives and implementing standardized dispensing protocols could substantially reduce inappropriate medication use.<sup>[31]</sup>

Overall, the present study demonstrates that self-medication among the elderly is shaped by a complex interplay of individual characteristics, social support systems, and structural healthcare factors. Addressing this issue requires a comprehensive and multifaceted approach, including improving health literacy, strengthening pharmacist engagement, reinforcing regulatory oversight of over-the-counter drug sales, and ensuring regular medication review for chronic disease management.

Future research should focus on longitudinal assessment of self-medication patterns and evaluation of clinical outcomes associated with unsupervised medication use among elderly populations.

#### **Limitation:**

This study has certain limitations. Being cross-sectional in design, causal relationships cannot be established. Self-medication practices were self-reported and may be subject to recall bias. Additionally, the study was conducted in a single urban field practice area, which may limit generalizability to other settings. Despite these limitations, the study provides valuable community-based evidence on self-medication practices among the elderly.

## Recommendations

- Promote regular medication review for elderly individuals, especially those with chronic diseases.
- Design and implement structured health education programs to improve awareness regarding risks of self-medication.
- Strengthen pharmacist-led education at community pharmacies to promote safe medication practices.
- Improve accessibility to primary healthcare services to reduce dependence on self-medication.
- Strengthen social and community support systems for elderly individuals living alone.
- Strengthen regulatory enforcement on over-the-counter drug sales to minimize inappropriate access to medications.

## Conclusion:

Self-medication was highly prevalent among elderly individuals residing in an urban community, with nearly two-thirds reporting the use of medicines without professional supervision. Minor health problems, prior experience with medications, and economic and accessibility factors were the most common reasons for self-medication. The practice was significantly associated with several socio-demographic and personal factors, including age, gender, education, living arrangement, habit status, and body mass index.

The frequent use of medications for chronic conditions such as antihypertensive and hypoglycaemic drugs highlights potential risks related to unsupervised medication use among the elderly. These findings underscore the need for targeted public health interventions focusing on health education, regular medication review, and promotion of rational drug use. Strengthening pharmacist-led education and improving access to affordable, age-friendly healthcare services may help reduce inappropriate self-medication and its associated risks in the elderly population.

## Declaration

### Conflict of Interest:

The authors declare no financial, institutional, or personal conflicts of interest.

### Funding:

No external funding was received; the study was conducted using institutional resources. The funding body had no role in study design, data collection, analysis, or manuscript preparation.

### AI Use:

No artificial intelligence tools were used in data collection, analysis, or manuscript drafting.

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## Nutritional Status and Determinants of Undernutrition among Under-Five Children in Migrant Populations of Ahmedabad, India: A Community based Cross-Sectional Study

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### Abstract:

**Introduction:** India is one of the largest contributors of child undernutrition globally. A complex relationship exists between migration and undernutrition. **Objectives:** 1. To assess the nutritional status of under 5 migrant children in Ahmedabad. 2. To find out the determinants of undernutrition among migrant children. **Method:** A cross-sectional study was conducted among 668 children (6-59 months) of migrant workers in 171 identified migrant settlements of Ahmedabad. Sampling was done proportionate to population size (PPS) of under 5 migrant children in 7 purposively selected Urban Primary Health Centres (UPHCs) of Ahmedabad. Primary data included anthropometric measurements of children & interviews of primary caregivers. Predictors of undernutrition were determined using logistic regression models. **Results:** The overall prevalence of undernutrition among under 5 migrant children was found to be 71.4%. The study found 300 (44.9%) participants to be underweight while stunting and wasting was present among 283 (42.4%) and 183 (27.4%) participants respectively. Food insecurity was found to be main predictor of wasting (AOR: 2.144,  $p < 0.001$ ) and being underweight (AOR: 2.386,  $p < 0.001$ ) while increased frequency of illness per year was major predictor for stunting (AOR: 1.745,  $p = 0.003$ ). Other important determinants were found to be age, birth weight, birth order, mother's working status, mother's education, socio-economic status, type of migration, number of migrations, immunization, age-appropriate feeding and registration in anganwadi. **Conclusion:** Undernutrition among under 5 children was remarkably high among the migrant population. Multiple factors affect nutritional status of children with increase in frequency of illness and food insecurity being major predictors of undernutrition.

**Keywords:** Food insecurity, Malnutrition, Migrant

### Introduction:

Malnutrition, still remains a major public health concern globally, contributing to nearly half of deaths among children under 5 years of age. Malnutrition, in all its forms, includes undernutrition (wasting, stunting, underweight), inadequate vitamins or minerals, overweight, obesity, and resulting diet-related noncommunicable diseases. In 2022, 149 million children under 5 years of age were estimated to be

stunted and 45 million were estimated to be wasted globally.<sup>[1]</sup> As per National Family Health Survey (NFHS-5) 2019-21, among under 5 years children, India accounted for 35.5% of them to be stunted, 19.3% to be wasted & 32.1% of them still to be underweight.<sup>[2]</sup> In comparison to the national data, undernutrition among under 5 children is considerably higher in Gujarat with 39% children reported to be stunted, 25.1% wasted and 39.7% underweight as per the survey.<sup>[3]</sup>

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It has been observed that the malnutrition problem in India is a concentrated phenomenon that is, a relatively small number of states, districts, and villages account for a large share of the malnutrition burden, only 5 states and 50% of villages account for about 80% of the malnutrition burden.<sup>[4]</sup> Apart from illness, socio-economic status, neglect, abnormal mealtimes, insufficient quantities of food and insufficient parental knowledge, malnutrition can also develop due to repeated, short term and unplanned migration. The developmental, economic, social, and medical impacts of migration related malnutrition are serious and lasting, for individuals and their families, for communities and for countries.<sup>[5]</sup>

Various studies conducted to examine the nutritional status of children have found a significant association between undernutrition and migration.<sup>[6,7]</sup> Rapid urban growth and decline in consistent agricultural produce, year after year has forced newly formed households to migrate to lucrative job opportunities at construction sites (road and building), transportation sector and other low-skilled daily wage jobs in cities, often seasonal in nature.<sup>[8]</sup>

Unplanned migration of this sort along with factors like illiteracy, infectious diseases, food insecurity, lack of understanding about immunization and age-appropriate feeding creates a situation where undernutrition among the children thrives.<sup>[9,10]</sup> There is a significant gap in the literature, when actual reason behind undernutrition is tried to be identified, especially among those who begin migration early in life, when nutritional insults have a longer-lasting impact.<sup>[6]</sup>

### Objectives:

1. To assess the nutritional status of under 5 migrant children in Ahmedabad.
2. To find out the determinants of undernutrition among migrant children.

### Methods:

It was a community based cross-sectional study conducted in migrant settlements of all the 7 zones of Ahmedabad Municipal Corporation (AMC), Gujarat from January 2024 to February 2025. The sample size was calculated using the formula:

$$N=4pq/L^2$$

where p is the estimated proportion of underweight children (39.7%) as per NFHS 5 – Gujarat factsheet (2019-20)<sup>[3]</sup> and L represent the relative allowable margin of error (10%) at 95% confidence interval. Taking 10% non-response rate, total sample size was calculated to be 668.

A multistage sampling approach was employed to select the study participants. To meet the sample size, one Urban Primary Health Centre (UPHC) having maximum number of migrant settlements from each zone of AMC was selected purposively. To determine the number of participants to be selected from each UPHC, sampling was done proportionate to population size (PPS) of under 5 migrant children in selected UPHCs of AMC.

Further, from each migrant settlement of the selected UPHC, total number of under 5 migrant children to be included in the study, were calculated using PPS. Lastly, snowball sampling was used to find & select the participants.

### Inclusion Criteria:

All the families who self-identified as an interstate migrant and/or fell into the category of migrant as per the study definition; having at least 1 child belonging to the age group of 6-59 months accompanying them were included in the study.

### Exclusion Criteria:

Families not willing to give consent were excluded from the study.

### Study Variables and Definitions:

In this study, migrants were defined as those families/ households who were living in Ahmedabad away from their usual place of residence (UPR) outside Gujarat for a period > 1 month.

Key variables like short term migrants were defined as those families/ households who were staying away from their UPR for a period greater than 1 month and maximum up to 12 months with at least one return back to home/ have intention to return back within above specified period while long term migrants were defined as those who have migrated from their native place (UPR) and were residing in Ahmedabad for at least 1 year with no intention to return back in near future.<sup>[11,12]</sup>

Primary outcomes were height-for-age z-scores (HAZ), weight-for-height z-scores (WHZ) & weight for age z-scores (WAZ), which if found below “2 Standard Deviations (SD) of the median of a reference standard as per WHO reference data,<sup>[13,14]</sup> were declared as stunted, wasted & underweight respectively.

Determinants like food security, was evaluated using Six-Item Short Form Economic research service.<sup>[15]</sup> Participants reported their household food consumption over the preceding 6 months. The household’s raw score was determined using total number of affirmative responses to the six items. A raw score of 0-1 indicated food security. Raw scores of 2-4 and 5-6 were classified as “low food security” and “very low food security,” respectively; both were categorized as food insecurity. Other determinants studied included Socio-economic status using BG Prasad classification (Financial year 2023-24, CPI: 138.9)<sup>[16]</sup>, frequency of child’s illness per year (Diarrhoea, Acute respiratory infection; ARI), Immunization status of the child till age was assessed according to Immunization cards or recall by parents.<sup>[17,18]</sup> Age-appropriate feeding status which was defined appropriate if the child received feeds in accordance to Infant & Young Child feeding (IYCF) & ICMR-NIN guidelines.<sup>[19,20]</sup>

#### Study Tool and Data Collection Technique:

Data was collected using face-to-face interviews with primary caretakers, conducted in the local vernacular language using pre-designed and pre-validated questionnaire. All the responses were recorded using pen-and-paper method. Questionnaire was specifically designed to gather information regarding socio-demographic characteristics, migration, illness pattern & determinants of undernutrition among under 5 children. Anthropometric measurements of the children were done using stadiometer or infantometer scale as appropriate, digital weighing scale and MUAC tape.

Prior to data collection, the investigator(s) underwent training in anthropometric measurement techniques as per the World Health Organization (WHO) Multicentre Growth Reference Study guidelines.<sup>[14]</sup> Measurements were obtained using standardized procedures with children wearing minimal clothing and

no footwear. Weight was measured to the nearest 0.1 kg using a digital weighing scale, while length/height was measured to the nearest 0.1 cm using an infantometer or stadiometer, as appropriate for the child’s age. MUAC was measured using a non-stretchable MUAC tape at the midpoint of the left upper arm.

The digital weighing scale was calibrated daily before data collection using standard known weights and was checked for a zero reading before each measurement. The infantometer, stadiometer, and MUAC tape were inspected regularly for alignment using rigid steel scale and checked for any signs of damage. To minimize measurement error, duplicate anthropometric measurements were obtained, and if the difference between the two measurements exceeded 0.1 kg for weight or 0.5 cm for length/height, a third measurement was taken. The average of the two closest measurements was used for analysis.

Ethical approval was obtained from Institutional Review Board (IRB) (NHLIRB/2024/January/13/No.9). After securing necessary permissions from health departments of AMC, families were identified and explained about the purpose of the study. Informed consent & assent was obtained followed by interview of parents and anthropometric measurements of the child. In case of presence of more than one child of the required age group in the same household, the youngest child was included in the study purposively.

Data was entered in Microsoft Excel and analysed through IBM Statistical Package for the Social Sciences (SPSS), version 27.

#### Statistical Analysis:

Descriptive analyses were performed to summarize the sociodemographic characteristics, migration specific details, nutritional status and various determinants of undernutrition. Univariate logistic regression was employed to assess statistically significant associations. All variables with p-value <0.1 in the bivariate analyses for any of the 3 outcomes (stunting, wasting or underweight) were included in the multivariate logistic regression models. Additionally key variables such as age and gender were included irrespective of statistical significance based on epidemiological relevance.

**Results:**

This study enrolled 668 under 5 migrant children and their primary caregivers for the purpose of the study. Majority of the children (376, 56.2%) completed their first migration before the age of 1 year and resided at or adjacent to construction sites (364, 54.5%).

Table 1 shows the socio-demographic characteristics and factors affecting nutritional status of the participants. The mean age of the children included in the study was 3 years (SD =  $\pm 1.4$ ). Majority of the families enrolled were nuclear (384, 57.5%), belonged to socio-economic class V (467, 69.9%) and were short

term migrants (364, 54.5%). In all the families, mothers were the primary caretaker with majority (499, 74.7%) having no primary education.

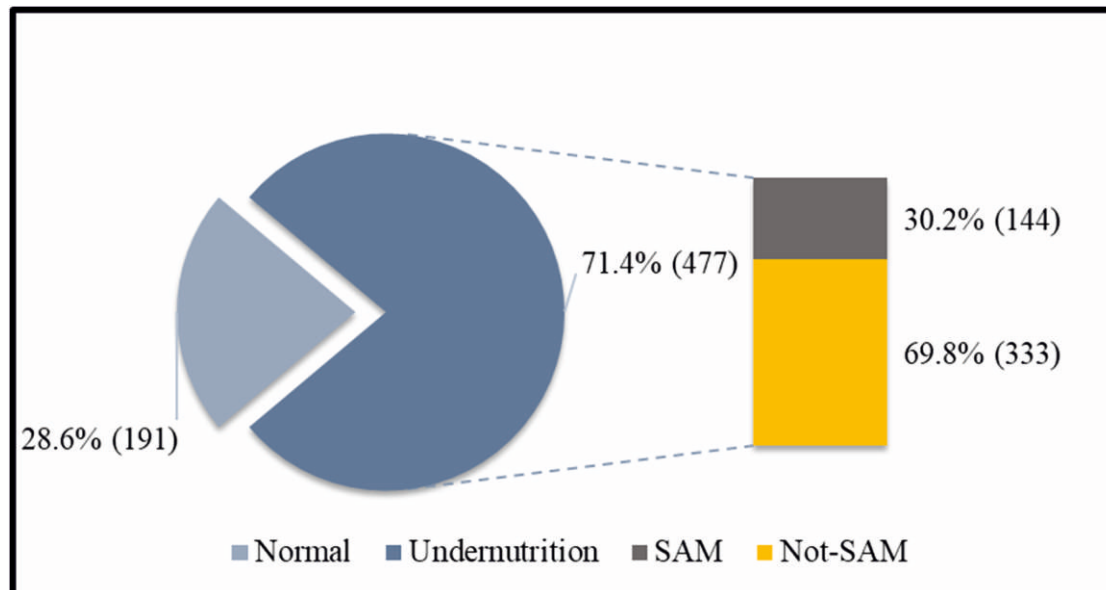
While most of the children (539, 80.7%) had normal birth weight, 129 (19.3%) children were born with low birth weight. Though majority of the children (382, 57.2%) were registered in Anganwadi (ICDS beneficiary), just 345 (51.6%) children were completely immunized as per age. More than 50% of the families (353, 52.8%) were not providing age-appropriate feeding to their children and were food insecure (385, 57.6%).

**Table 1: Socio demographic characteristics and factors affecting nutritional status of study participants (N=668)**

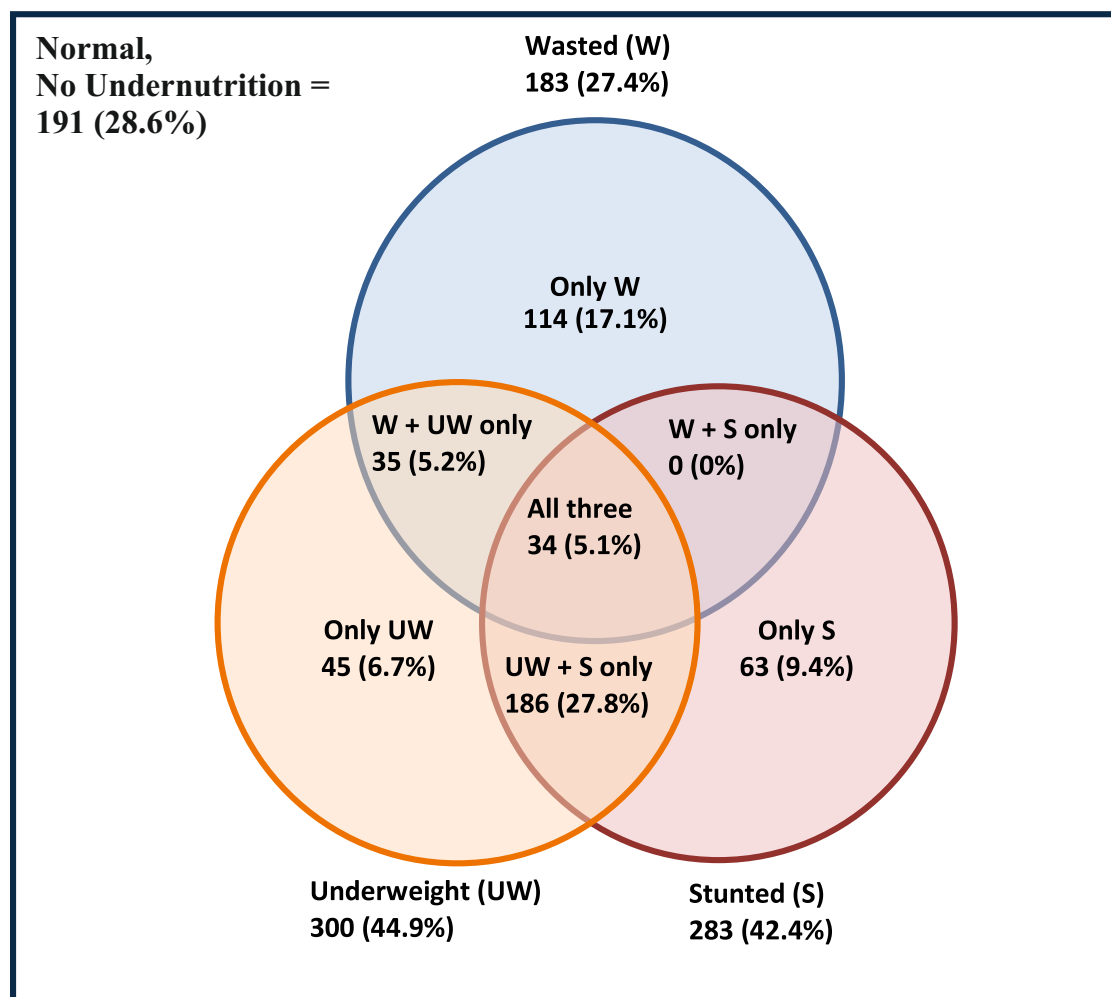
| S.no | Variables                         | Categories                  | Frequency, n(%) |
|------|-----------------------------------|-----------------------------|-----------------|
| 1    | Age group of the child (in years) | $\leq 3$                    | 239 (35.8)      |
|      | Mean age = $3.0 \pm 1.4$ SD       | $> 3$                       | 429 (64.2)      |
| 2    | Gender of the child               | Male                        | 331 (49.6)      |
|      |                                   | Female                      | 337 (50.4)      |
| 3    | Religion                          | Hindu                       | 399 (59.7)      |
|      |                                   | Others                      | 269 (40.3)      |
| 4    | Birth weight                      | Normal                      | 539 (80.7)      |
|      |                                   | LBW                         | 129 (19.3)      |
| 5    | Birth order                       | $\leq 2$                    | 506 (75.7)      |
|      |                                   | $> 2$                       | 162 (24.3)      |
| 6    | Mother's Education                | No formal education         | 499 (74.7)      |
|      |                                   | Primary education or better | 169 (25.3)      |
| 7    | Mother's working status           | Working                     | 385 (57.6)      |
|      |                                   | Not working                 | 283 (42.4)      |
| 8    | Family Type                       | Joint                       | 284 (42.5)      |
|      |                                   | Nuclear                     | 384 (57.5)      |
| 9    | Socio-economic status             | Class IV or better          | 201 (30.1)      |
|      |                                   | Class V                     | 467 (69.9)      |
| 10   | Type of migration                 | Short-term                  | 364 (54.5)      |
|      |                                   | Long-term                   | 304 (45.5)      |
| 11   | Number of migrations till age     | $< 2$                       | 285 (42.7)      |
|      |                                   | $\geq 2$                    | 383 (57.3)      |
| 12   | Food insecurity                   | Present                     | 385 (57.6)      |
|      |                                   | Absent                      | 283 (42.4)      |
| 13   | Immunization till age             | Present                     | 345 (51.6)      |
|      |                                   | Absent                      | 323 (48.4)      |
| 14   | Age-appropriate feeding           | Provided                    | 315 (47.2)      |
|      |                                   | Not provided                | 353 (52.8)      |
| 15   | Frequency of illness per year     | $\leq 5$ times              | 384 (57.5)      |
|      |                                   | $> 5$ times                 | 284 (42.5)      |
| 16   | ICDS beneficiary                  | Yes                         | 382 (57.2)      |
|      |                                   | No                          | 286 (42.8)      |

ICDS: Integrated Child Development Services, LBW: Low Birth Weight

**Graph 1: Nutritional status of the study participants (N=668)**



**Graph 2: Distribution of participants based on the type of undernutrition (N=668)**



**Table 2: Determinants of underweight among under 5 migrant children (N=668)**

| Variables                            | Categories                  | Underweight present, n=300(%) | Underweight absent, n(%) | COR (95% CI)        | AOR (95% CI)        | p-value |
|--------------------------------------|-----------------------------|-------------------------------|--------------------------|---------------------|---------------------|---------|
| <b>Age group (years)</b>             | ≤ 3                         | 90 (37.7)                     | 149 (62.3)               | 1 (Referent)        | 1 (Referent)        | 0.016   |
|                                      | > 3                         | 210 (49)                      | 219 (51)                 | 1.588 (1.149-2.193) | 1.607 (1.093-2.361) |         |
| <b>Gender</b>                        | Female                      | 143 (42.4)                    | 194 (57.6)               | 1 (Referent)        | 1 (Referent)        | 0.075   |
|                                      | Male                        | 157 (47.4)                    | 174 (52.6)               | 1.224 (0.902-1.661) | 1.363 (0.969-1.918) |         |
| <b>Birth weight</b>                  | LBW                         | 70 (54.3)                     | 59 (45.7)                | 1 (Referent)        | 1 (Referent)        | 0.015   |
|                                      | Normal                      | 230 (42.7)                    | 309 (57.3)               | 0.627 (0.426-0.923) | 0.590 (0.385-0.904) |         |
| <b>Birth order</b>                   | ≤ 2                         | 223 (44.1)                    | 283 (55.9)               | 1 (Referent)        | 1 (Referent)        | 0.396   |
|                                      | > 2                         | 77 (47.5)                     | 85 (52.5)                | 1.150 (0.806-1.639) | 1.194 (0.793-1.800) |         |
| <b>Socio-economic status</b>         | Class V                     | 227 (48.6)                    | 240 (51.4)               | 1 (Referent)        | 1 (Referent)        | 0.039   |
|                                      | Class IV or better          | 73 (36.3)                     | 128 (63.7)               | 0.603 (0.429-0.847) | 0.663 (0.411-0.977) |         |
| <b>Mother's Education</b>            | No formal education         | 239 (47.9)                    | 260 (52.1)               | 1 (Referent)        | 1 (Referent)        | 0.545   |
|                                      | Primary education or better | 61 (36.1)                     | 108 (63.9)               | 0.614 (0.429-0.880) | 0.883 (0.590-1.321) |         |
| <b>Mother's working status</b>       | Not working                 | 139 (49.1)                    | 144 (50.9)               | 1 (Referent)        | 1 (Referent)        | 0.690   |
|                                      | Working                     | 161 (41.8)                    | 224 (58.2)               | 0.745 (0.547-1.014) | 0.920 (0.611-1.386) |         |
| <b>Type of Migration</b>             | Short-term                  | 195 (53.6)                    | 169 (46.4)               | 1 (Referent)        | 1 (Referent)        | < 0.001 |
|                                      | Long-term                   | 105 (34.5)                    | 199 (65.5)               | 0.457 (0.334-0.626) | 0.460 (0.325-0.652) |         |
| <b>Number of migrations till age</b> | ≤ 2                         | 107 (37.5)                    | 178 (62.5)               | 1 (Referent)        | 1 (Referent)        | 0.591   |
|                                      | > 2                         | 193 (50.4)                    | 190 (49.6)               | 1.690 (1.236-2.310) | 1.103 (0.770-1.580) |         |
| <b>Immunization till age</b>         | Absent                      | 160 (49.5)                    | 163 (50.5)               | 1 (Referent)        | 1 (Referent)        | 0.149   |
|                                      | Present                     | 140 (40.6)                    | 205 (59.4)               | 0.696 (0.512-0.945) | 0.770 (0.541-1.098) |         |
| <b>Food Insecurity</b>               | Absent                      | 89 (31.4)                     | 194 (68.6)               | 1 (Referent)        | 1 (Referent)        | < 0.001 |
|                                      | Present                     | 211 (54.8)                    | 174 (45.2)               | 2.643 (1.917-3.645) | 2.386 (1.638-3.474) |         |
| <b>Frequency of illness per year</b> | ≤ 5 times                   | 147 (38.3)                    | 237 (61.7)               | 1 (Referent)        | 1 (Referent)        | < 0.001 |
|                                      | > 5 times                   | 153 (53.9)                    | 131 (46.7)               | 1.883 (1.380-2.570) | 1.981 (1.383-2.838) |         |
| <b>Age- Appropriate feeding</b>      | Not provided                | 185 (52.4)                    | 168 (47.6)               | 1 (Referent)        | 1 (Referent)        | 0.012   |
|                                      | Provided                    | 115 (36.5)                    | 200 (63.5)               | 0.522 (0.383-0.712) | 0.627 (0.435-0.907) |         |
| <b>ICDS beneficiary</b>              | No                          | 142 (49.7)                    | 144 (50.3)               | 1 (Referent)        | 1 (Referent)        | 0.848   |
|                                      | Yes                         | 158 (41.4)                    | 224 (58.6)               | 0.715 (0.525-0.974) | 0.966 (0.679-1.374) |         |

COR was determined using univariate binary logistic regression. COR: Crude odds ratio, AOR: Adjusted odds ratio, CI: Confidence interval

**Table 3: Determinants of wasting among under 5 migrant children (N=668)**

| Variables                                | Categories                     | Wasting<br>present,<br>n=183(%) | Wasting)<br>absent,<br>n (%) | COR<br>(95% CI)     | AOR<br>(95% CI)     | p-value |
|------------------------------------------|--------------------------------|---------------------------------|------------------------------|---------------------|---------------------|---------|
| <b>Age group (years)</b>                 | ≤ 3                            | 65 (27.2)                       | 174 (72.8)                   | 1 (Referent)        | 1 (Referent)        | 0.459   |
|                                          | > 3                            | 118 (27.5)                      | 311 (72.5)                   | 1.016 (0.712-1.449) | 1.170 (0.773-1.771) |         |
| <b>Gender</b>                            | Female                         | 100 (29.7)                      | 237 (70.3)                   | 1 (Referent)        | 1 (Referent)        | 0.093   |
|                                          | Male                           | 83 (25.1)                       | 248 (74.9)                   | 0.793 (0.564-1.116) | 0.729 (0.503-1.055) |         |
| <b>Birth weight</b>                      | LBW                            | 33 (25.6)                       | 96 (74.4)                    | 1 (Referent)        | 1 (Referent)        | 0.661   |
|                                          | Normal                         | 150 (27.8)                      | 389 (72.2)                   | 1.122 (0.724-1.738) | 0.898 (0.556-1.451) |         |
| <b>Birth order</b>                       | ≤ 2                            | 125 (24.7)                      | 381 (75.3)                   | 1 (Referent)        | 1 (Referent)        | 0.011   |
|                                          | > 2                            | 58 (35.8)                       | 104 (64.2)                   | 1.700 (1.163-2.484) | 1.761 (1.141-2.716) |         |
| <b>Socio-economic<br/>status</b>         | Class V                        | 126 (27)                        | 341 (73)                     | 1 (Referent)        | 1 (Referent)        | 0.438   |
|                                          | Class IV<br>or better          | 57 (28.4)                       | 144 (71.6)                   | 1.071 (0.741-1.549) | 1.202 (0.755-1.916) |         |
| <b>Mother's<br/>Education</b>            | No formal<br>education         | 154 (30.9)                      | 345 (69.1)                   | 1 (Referent)        | 1 (Referent)        | 0.012   |
|                                          | Primary education<br>or better | 29 (17.2)                       | 140 (82.8)                   | 0.464 (0.298-0.722) | 0.546 (0.340-0.875) |         |
| <b>Mother's working<br/>status</b>       | Not working                    | 72 (25.4)                       | 211 (74.6)                   | 1 (Referent)        | 1 (Referent)        | 0.633   |
|                                          | Working                        | 111 (28.8)                      | 274 (71.2)                   | 1.187 (0.839-1.679) | 1.115 (0.713-1.745) |         |
| <b>Type of Migration</b>                 | Short-term                     | 114 (31.3)                      | 250 (68.7)                   | 1 (Referent)        | 1 (Referent)        | 0.091   |
|                                          | Long-term                      | 69 (22.7)                       | 235 (77.3)                   | 0.644 (0.455-0.912) | 0.721 (0.493-1.053) |         |
| <b>Number of<br/>migrations till age</b> | ≤ 2                            | 59 (20.7)                       | 226 (79.3)                   | 1 (Referent)        | 1 (Referent)        | 0.195   |
|                                          | > 2                            | 124 (32.4)                      | 259 (67.6)                   | 1.834 (1.282-2.622) | 1.304 (0.873-1.946) |         |
| <b>Immunization<br/>till age</b>         | Absent                         | 119 (36.8)                      | 204 (63.2)                   | 1 (Referent)        | 1 (Referent)        | < 0.001 |
|                                          | Present                        | 64 (18.6)                       | 281 (81.4)                   | 0.390 (0.274-0.566) | 0.487 (0.331-0.716) |         |
| <b>Food Insecurity</b>                   | Absent                         | 50 (17.7)                       | 233 (82.3)                   | 1 (Referent)        | 1 (Referent)        | < 0.001 |
|                                          | Present                        | 133 (34.5)                      | 252 (65.5)                   | 2.459 (1.698-3.563) | 2.144 (1.405-3.270) |         |
| <b>Frequency of illness<br/>per year</b> | ≤ 5 times                      | 101 (26.3)                      | 283 (73.7)                   | 1 (Referent)        | 1 (Referent)        | 0.752   |
|                                          | > 5 times                      | 82 (28.9)                       | 202 (71.1)                   | 1.137 (0.807-1.602) | 0.939 (0.636-1.386) |         |
| <b>Age-Appropriate<br/>feeding</b>       | Not provided                   | 106 (30)                        | 247 (70)                     | 1 (Referent)        | 1 (Referent)        | 0.695   |
|                                          | Provided                       | 77 (24.4)                       | 238 (75.6)                   | 0.754 (0.535-1.063) | 1.084 (0.724-1.623) |         |
| <b>ICDS beneficiary</b>                  | No                             | 100 (35)                        | 186 (65)                     | 1 (Referent)        | 1 (Referent)        | 0.021   |
|                                          | Yes                            | 83 (21.7)                       | 299 (78.3)                   | 0.516 (0.366-0.728) | 0.640 (0.438-0.936) |         |

COR was determined using univariate binary logistic regression. COR: Crude odds ratio, AOR: Adjusted odds ratio, CI: Confidence interval

**Table 4: Determinants of stunting among under 5 migrant children (N=668)**

| Variables                                | Categories                     | Stunting<br>present,<br>n=283(%) | Stunting<br>absent,<br>n(%) | COR<br>(95% CI)     | AOR<br>(95% CI)     | p-value |
|------------------------------------------|--------------------------------|----------------------------------|-----------------------------|---------------------|---------------------|---------|
| <b>Age group (years)</b>                 | ≤ 3                            | 106 (44.4)                       | 133 (55.6)                  | 1 (Referent)        | 1 (Referent)        | 0.013   |
|                                          | > 3                            | 177 (41.3)                       | 252 (58.7)                  | 0.881 (0.640-1.213) | 0.644 (0.456-0.910) |         |
| <b>Gender</b>                            | Female                         | 147 (43.6)                       | 190 (56.4)                  | 1 (Referent)        | 1 (Referent)        | 0.050   |
|                                          | Male                           | 136 (41.1)                       | 195 (58.9)                  | 0.901 (0.663-1.225) | 0.681 (0.463-1.000) |         |
| <b>Birth weight</b>                      | LBW                            | 56 (43.4)                        | 73 (56.6)                   | 1 (Referent)        | 1 (Referent)        | 0.751   |
|                                          | Normal                         | 227 (42.1)                       | 312 (57.9)                  | 0.948 (0.644-1.398) | 0.932 (0.604-1.439) |         |
| <b>Birth order</b>                       | ≤ 2                            | 230 (45.5)                       | 276 (54.5)                  | 1 (Referent)        | 1 (Referent)        | 0.009   |
|                                          | > 2                            | 53 (32.7)                        | 109 (67.3)                  | 0.583 (0.402-0.846) | 0.566 (0.369-0.867) |         |
| <b>Socio-economic<br/>status</b>         | Class V                        | 218 (46.7)                       | 249 (53.3)                  | 1 (Referent)        | 1 (Referent)        | 0.107   |
|                                          | Class IV or<br>better          | 65 (32.3)                        | 136 (67.7)                  | 0.546 (0.386-0.772) | 0.695 (0.447-1.081) |         |
| <b>Mother's<br/>Education</b>            | No formal<br>education         | 219 (43.9)                       | 280 (56.1)                  | 1 (Referent)        | 1 (Referent)        | 0.450   |
|                                          | Primary education<br>or better | 64 (37.9)                        | 105 (62.1)                  | 0.779 (0.545-1.114) | 1.167 (0.782-1.743) |         |
| <b>Mother's working<br/>status</b>       | Not working                    | 152 (53.7)                       | 131 (46.3)                  | 1 (Referent)        | 1 (Referent)        | <0.001  |
|                                          | Working                        | 131 (34)                         | 254 (66)                    | 0.444 (0.324-0.609) | 0.397 (0.262-0.603) |         |
| <b>Type of Migration</b>                 | Short-term                     | 178 (48.9)                       | 186 (51.1)                  | 1 (Referent)        | 1 (Referent)        | 0.391   |
|                                          | Long-term                      | 105 (34.5)                       | 199 (65.5)                  | 0.551 (0.403-0.754) | 0.861 (0.612-1.212) |         |
| <b>Number of<br/>migrations till age</b> | ≤ 2                            | 92 (32.3)                        | 193 (67.7)                  | 1 (Referent)        | 1 (Referent)        | 0.014   |
|                                          | > 2                            | 191 (49.9)                       | 192 (50.1)                  | 2.087 (1.517-2.871) | 1.569 (1.094-2.249) |         |
| <b>Immunization<br/>till age</b>         | Absent                         | 148 (45.8)                       | 175 (54.2)                  | 1 (Referent)        | 1 (Referent)        | 0.188   |
|                                          | Present                        | 135 (39.1)                       | 210 (60.9)                  | 0.760 (0.559-1.034) | 0.787 (0.552-1.124) |         |
| <b>Food Insecurity</b>                   | Absent                         | 90 (31.8)                        | 193 (68.2)                  | 1 (Referent)        | 1 (Referent)        | 0.006   |
|                                          | Present                        | 193 (50.1)                       | 192 (49.9)                  | 2.156 (1.565-2.969) | 1.694 (1.164-2.465) |         |
| <b>Frequency of<br/>illness per year</b> | ≤ 5 times                      | 147 (38.3)                       | 237 (61.7)                  | 1 (Referent)        | 1 (Referent)        | 0.003   |
|                                          | > 5 times                      | 136 (47.9)                       | 148 (52.1)                  | 1.482 (1.086-2.021) | 1.745 (1.213-2.512) |         |
| <b>Age-Appropriate<br/>feeding</b>       | Not provided                   | 178 (50.4)                       | 175 (49.6)                  | 1 (Referent)        | 1 (Referent)        | 0.002   |
|                                          | Provided                       | 105 (33.3)                       | 210 (66.7)                  | 0.492 (0.359-0.673) | 0.554 (0.383-0.802) |         |
| <b>ICDS beneficiary</b>                  | No                             | 132 (46.2)                       | 154 (53.8)                  | 1 (Referent)        | 1 (Referent)        | 0.989   |
|                                          | Yes                            | 151 (39.5)                       | 231 (60.5)                  | 0.763 (0.559-1.040) | 1.002 (0.704-1.427) |         |

COR was determined using univariate binary logistic regression. COR: Crude odds ratio, AOR: Adjusted odds ratio, CI: Confidence interval

Graph 1 & 2 demonstrates the nutritional status of the migrant children studied. A large majority of the children (477, 71.4%) were undernourished with 283 (42.4%), 183 (27.4%) and 300 (44.9%) participants found to be stunted, wasted and underweight respectively. Among all the participants, severe acute malnutrition (SAM) was present in 144 (21.6%) children. While majority of the participants had pallor (370, 55.4%), bilateral pedal edema and visible signs of wasting were present in just 21 (3.1%) and 110 (16.5%) children respectively.

Table 2 depicts the predictors of underweight among under 5 migrant children. Migrant children aged more than 3 years had significantly higher odds (adjusted odds ratio [AOR]: 1.607; 95% CI: 1.093-2.361;  $p=0.016$ ), while children born with normal birthweight (AOR=0.590 ; 95% CI: 0.385-0.904;  $p=0.015$ ) had significantly lower odds of being underweight. Children belonging to long-term migrant families (AOR=0.460; 95% CI: 0.325-0.652);  $p<0.001$ ) and class IV or better socio-economic class (AOR=0.663; 95% CI: 0.411-0.977;  $p=0.039$ ) had significantly lower odds of becoming underweight. Migrant children in families facing food insecurity (AOR=2.386; 95% CI: 1.638-3.474;  $p<0.001$ ) were significantly more likely to be underweight as compared to their food secure counterparts. Similarly, children who had more than 5 episodes of illness per year (AOR=1.981; 95% CI: 1.383-2.838;  $p<0.001$ ) had significantly higher chances of being underweight. Furthermore, children who received age-appropriate feeding months (AOR=0.627; 95% CI: 0.435-0.907;  $p=0.012$ ) had significantly lower odds of being underweight.

Table 3 & 4 depicts the predictors of wasting and stunting among under 5 migrant children respectively. Wasting was significantly higher among children with families facing food insecurity (AOR=2.144; 95% CI: 1.405-3.270;  $p<0.001$ ) and birth order more than 2 (AOR=1.761; 95% CI: 1.141-2.716;  $p=0.011$ ). Children who were immunized till age (AOR=0.487; 95% CI: 0.331-0.716;  $p<0.001$ ), had mothers with primary education or better (AOR=0.546; 95% CI: 0.340-0.875;  $p=0.012$ ) and were ICDS beneficiaries (AOR=0.640; 95% CI: 0.438-0.936;  $p=0.021$ ) had significantly lower odds of becoming wasted.

Stunting was significantly higher among children who underwent more than 2 migrations till age (AOR=1.569; 95% CI: 1.094-2.249;  $p=0.014$ ), had more than 5 episodes of illness per year (AOR=1.745; 95% CI: 1.213-2.512;  $p=0.003$ ) and belonged to families who were food insecure (AOR=1.694; 95% CI: 1.164-2.465;  $p=0.006$ ). Migrant children aged > 3 years (AOR=0.644; 95% CI: 0.456-0.910;  $p=0.013$ ), had birth order >2 (AOR=0.566; 95% CI: 0.369-0.867;  $p=0.009$ ), had working mothers (AOR=0.397; 95% CI: 0.262-0.603;  $p<0.001$ ) and received age-appropriate feeding (AOR=0.554; 95% CI: 0.383-0.802;  $p=0.002$ ) had significantly lower odds of being stunted.

### Discussion:

This study was conducted among the migrant children belonging to the age group of 6 to 59 months in migrant settlements of Ahmedabad which is similar to study conducted by Roshania et al.<sup>[6]</sup> which focussed on migrant children in brick kilns of Bihar. This study was one of its kind as it provided details about undernutrition among interstate migrants rather than resident citizens of the state.

The mean age of the participants in the present study was 3 years (SD± 1.4) which was similar to the findings by Singh et al.<sup>[21]</sup> where mean age of the participants was 3.05 years (±SD 1.27) but was in contrast to the findings of the studies conducted by Murarkar et al.<sup>[22]</sup> and Kachhawala F et al.<sup>[23]</sup> where mean age of the participants were 2.38 years (±SD 1.36) and 2.75 years (±SD 0.10) respectively. There was a balanced sex distribution among the participants with proportion of females (337, 50.4%) being marginally higher than the males which was in contrast with findings of Chakraborty et al.<sup>[24]</sup> where proportion of males (50.4%) were higher than the females. In this study, 74.7% of the mothers had no formal education which was in contrast to the findings by Singh et al.<sup>[21]</sup>, Chakraborty et al.<sup>[24]</sup> and Patra M et al.<sup>[25]</sup>, where mere 5.1%, 4.8% and 32.7%, of the mothers/primary caretakers had no formal education.

It was observed that the overall prevalence of stunting among migrant children under five years of age was 42.4%, wasting was 27.4% and 44.9% children were underweight, which was comparatively higher than

the city average of 17.5% wasting, 35.5% stunting & 34% underweight respectively.<sup>[26]</sup> The findings were reasonably different from the studies conducted by Murarkar et al.<sup>[22]</sup> where 45.9% children were stunted, 17.1% were wasted and 35.4% children were underweight. Present study found 71.4% of the participants to be undernourished which was extremely high when compared to the findings by Farooq U et al.<sup>[27]</sup> and Garg et al.<sup>[28]</sup> where 64.2% and 58.2% of the under 5 children were undernourished.

This study found the age of the child to be significantly associated with stunting and underweight; the increase in the former accentuated the odds of underweight, which is congruent to the study results of Chakraborty et al.<sup>[24]</sup> Higher odds of wasting were found among the children having birth order >2 which was in contrast to the findings by Singh et al.<sup>[21]</sup> and Murarkar et al.<sup>[22]</sup>, where none of the nutritional parameters had any association with birth order of children. In this study, wasting was found to be significantly higher among the children whose mothers had no formal education which was in line with findings observed by Chakraborty et al.<sup>[24]</sup>

Children with incomplete immunization till age were found to be significantly prone to wasting in the present study. Singh et al.<sup>[21]</sup> and Kachhawala F et al.<sup>[23]</sup>, however found complete immunization till age to be a significant predictor of being underweight rather than wasting. This study found food insecurity to be a major predictor of all the 3 forms of undernutrition among under 5 children. Similar findings were observed by Roshania et al.<sup>[6]</sup> among the circular migrants in brick kilns of Bihar. Present study found migrant children with high frequency of illness per year being more prone to stunting and being underweight which was in line with the findings by Roshania et al.<sup>[6]</sup> Migrant children who received age-appropriate feeding had significantly lower odds of being underweight and stunted in the present study. Similar findings were observed by Kachhawala F et al.<sup>[23]</sup>, where prevalence of malnutrition was higher among those who received faulty feeding by their caretakers. Further, increased number of migratory episodes significantly increased the chances of stunting

among under 5 children. Similar findings were observed by Roshania et al.<sup>[6]</sup> where child migrants who had migrated multiple times beginning early in life were especially more vulnerable to chronic undernutrition as compared to those children who experienced single migration.

#### **Limitation:**

This study focused only on the migrants residing in urban slums and construction sites, thus findings in the study were representative only of the sampled migrant settlements and could not be generalized to all migrants. It was difficult to avoid recall bias, especially while assessing the immunization status of child because majority of the mothers had no formal education and necessary documents. Further, due to statistical constraints, all the postulated factors affecting the nutritional status of children were not studied.

#### **Conclusions:**

The study provided an insight into the nutritional status of under 5 migrant children and the predictors of undernutrition among them. This study found high percentage of child migrants (71.4%) to be undernourished. Majority of the participants (44.9%) were underweight while 44.2% were stunted and 27.4% of the participants were wasted. Food insecurity was found to be one of the main predictors of wasting (AOR: 2.144,  $p < 0.001$ ) and being underweight (AOR: 2.386,  $p < 0.001$ ) while increased frequency of illness per year was found to be the major predictor of stunting (AOR: 1.745,  $p = 0.003$ ) among under 5 migrant children.

#### **Recommendation:**

d. It is recommended that UPHCs conduct scheduled monthly awareness camps and outreach clinics in migrant settlements for growth monitoring, addressing incomplete immunizations, prompt diagnosis and treatment of common infections and assessing feeding practices among migrant mothers. Migrant specific food support schemes should be devised at destination sites provided parallel to public distribution system (PDS) sites to tackle food insecurity. Mandatory registration of migrant children under ICDS should be ensured with provision of take-home rations.

## Declaration:

Conflict of Interest: None declared

Funding: None

Use of AI: None

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