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Perspectives and Issues



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Assessment of Nutritional Status of Adolescent Girls (13-15 Years) and Their Knowledge, Attitude and Practices (KAP) on Menstruation

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Abstract

A cross-sectional study was conducted in two schools of Delhi NCR among 100 adolescent girls (13-15 years) to assess their nutritional status and KAP regarding menstruation, menstrual health and hygiene, food choices, myths and misconceptions related to menstruation. Nutritional status of 80 per cent belonging to middle income group was in the normal range. Also, the height for age for 85 per cent of subjects was normal. The energy and protein intake met 61.04 ± 10.22 per cent and 93.98 ± 19.82 per cent adequacy, respectively. More than 50 per cent girls had some food restriction during menstruation. The age of menarche was 12 ± 1.58 years. A correlation was observed between BMI and age of menarche ($r = -0.29$, $p < 0.01$). Majority of subjects had good to fair knowledge (4.35 ± 1.27) and practices (15.01 ± 2.05) score regarding hygiene and sanitation, disposal of waste material and food choices during menstruation. There was an association between Socio-economic status and Nutritional status ($p < 0.03$).

Key words: Adolescent girls, nutritional status, menstruation, BMI, KAP

Introduction

Adolescence is that stage of life which bridges childhood to adulthood in a person. It is like a transition between the two phases of life. The age of a person during adolescence ranges from 10-19 years of age according to World Health Organization (WHO). India's adolescent's population is the largest in the world. In India, the population of adolescents is nearly one-fifth of the total population^{1,2}. Adolescence begins with puberty. Puberty is a time when a girl/boy becomes sexually mature. It brings a lot of physical changes in the body which are called secondary sexual characteristics like pubic hairs, change in body shape, facial hairs (in case of boys) along with menstruation (in girls), etc. Adolescents also face health problems like undernutrition, stunting, wasting and iron deficiency anaemia. Some adolescents on the other hand are affected by over-nutrition, obesity, cardiovascular diseases and in some cases early osteoarthritis. Girls are more prone to these problems³.

Menstruation is a monthly discharge of blood from the uterus which flows out through the vagina in females. It generally lasts for 4-5 days and repeats after every 28-30 days. Nearly 1.8 billion girls across the world menstruate every year⁴. The first period, when a girl menstruates for the first time in her life is called the Menarche, that is, the beginning of the menstrual process. The first menstruation in girls is generally traumatizing and scary for her. It starts at around the age

of 12 to 15 years on an average. But now menarche has started to begin as early as at the age of 10-12 years. Menopause is the last period that is, the last menstruation which occurs generally at the age of 50-55 years. Every woman on an average gets around 300+ menstruations in her life and about 12 menstruations in a year⁵.

Different cultures have different beliefs about menstruation. In some cultures, it is considered that girls are not allowed to do basic activities like to sit with everyone or to touch pickles or eat any sour or cold food, they are not allowed to do any holy activity or visit any religious place or enter into the kitchen, and they are not allowed to change their clothes or take daily bath or water on Tulsi plant. In some places girls are given separate rooms, beds, utensils to use during menstruation. But contrary to these practices, in south India when a girl begins with periods, it is considered an auspicious sign of nature. It becomes a celebration and girls are treated like a goddess⁶. Due to restrictions imposed on girls after menarche, food items like curd, rice, lassi, milk, etc. are prohibited. Adolescent girls are prone to many nutrition deficiencies as their health status is completely neglected. In some orthodox families, girls are not given healthy food items, and are bound to eat leftovers⁷. Hence, their nutritional status gets deterred during early adolescence years. Low socio-economic status (SES), lack of good health care facilities and lack of education are the main causes of the negligence of health in early adolescent girls. Unhygienic sanitary practices like using uncleaned or reusing same cloth, not drying it properly, etc. and lack of preparation for managing menstruation, lack of privacy of changing absorbent materials also leads to deterioration of health of early adolescent girls. Sometimes girls have no other option other than using cloth as absorbent material because of its ease of availability and low cost. It can also result in different urogenital diseases, gynecological problems and psychosocial stress on girls. It leads to poor school performances and school drop-outs which indirectly affects the country's economy. To overcome these issues, we need to have proper education before or after menarche, proper sanitation facility, water supply, absorbent material disposal facility, positive social norms and government regulated policies. So in the present study the nutritional status and knowledge, attitude and practices of adolescent girls (13-15 years) regarding menstruation, menstrual health and hygiene practices, food choices and myths & misconceptions was studied.

Objectives

The basic objectives of the study were to assess

- the nutritional status of the adolescent girls aged 13-15 years, and
- their knowledge, attitude and practices on menstruation.

Methodology

The study design was cross-sectional and descriptive in nature. The study was conducted in two schools of Delhi and Faridabad, namely- Murti Devi Public School, Burari, Delhi (Private school) and Government Model Senior Secondary School, Sarai Khawaja, Faridabad. These two schools were purposively selected as these were accessible and convenient to the investigator. 100 adolescent girls aged 13-15 years of these two schools who had attained menarche and were having regular menstrual cycle, were selected for study. Adolescent girls whose parents had given written consent for participation of their daughters in the study were included as sample

respondents while those girls suffering from any disease like PCOD, Diabetes, Cardio Vascular Disease (CVD) or any kind of chronic illness or person with disabilities or who were observing fasts during the study period were excluded from the study.

Sampling Technique: Non-Probability sampling method was used as per the convenience of the investigator. Purposive sampling method was used for the selection of the sample units. A pre-structured questionnaire containing close ended (multiple choice) questions were used to collect the information on the study variables (socio-demographic, menstruation background, anthropometric measurements and dietary intake, Knowledge, Attitude and Practices towards menstruation). The questionnaire was prepared in both English and Hindi language.

Socio-Demographic Profile of the subjects: The structured questionnaire was used to collect the information like Name, age, religion, Socio-Economic Class was evaluated by Kuppuswamy updated 2022 scale.

Assessment of Nutritional status

i) Anthropometric Measurements: The anthropometry was assessed on the basis of height, weight & BMI. BMI was evaluated by WHO, 2007 guidelines.

ii) Dietary intake: 24 Hours Recall methods were used for 3 days to assess dietary intakes of subjects on two working days and a holiday. In this method, subjects were asked to recall the food intake for the past 24 hours in as much detail as possible. Once the amount of raw food was known, estimation of nutrient content of Energy, Protein, Carbohydrates, Fats, Iron and Folic Acid of the food consumed was done with the help of IFCT Table, 2017. The data thus obtained was used for assessing the adequacy of the diet by comparing intake with the RDA, 2020 to determine the percentage adequacy of intake.

Assessing the menstruation background and Knowledge, Attitude & Practices towards menstruation among the study subjects

For assessing these, a self-made questionnaire was developed.

i) Assessment of Menstruation background of subjects: The questionnaire consisted of 6 set of multiple choice questions related to menstruation background of subjects. There were no correct or incorrect scores. All the options were given codes from 1-4. This section contained questions on age at menarche, duration of menstrual flow, duration of menstrual cycle, menstrual problems faced, who informed about menstruation and role of mass media in menstruation.

ii) Assessment of Knowledge: The knowledge questionnaire consisted of 6 items with multiple choice questions related to knowledge of subjects about menstruation. For all the questions, there was one correct answer & 1 mark was awarded for each correct answer and all the incorrect responses were marked 0. This section included questions like knowledge about menstruation before it occurred, hygiene & sanitation practices during menstruation, food choices after menarche, appropriate method of disposing off the absorbent materials and products used for cleaning the genitals. A maximum of 6 points could be attained in this section. The knowledge score was categorised as good, fair and poor knowledge.

iii) Assessment of Attitude: The attitude questionnaire comprised of 5 items relating to the attitude of subjects towards the experience of menstruation, prior knowledge of menstruation, hygiene & sanitation during menstruation, menstruation as a taboo and eating habits during menstruation. The rating scale was designed as a five point likert scale with the response options strongly agree, agree, neutral, disagree & strongly disagree. Some of the statements were formulated positively & some were inversely. A high overall score reflected a positive attitude and a low overall score indicated a negative attitude. The maximum score was 25 and minimum was 5.

iv) Assessment of Practice: The practice questionnaire consisted of 25 items with multiple choice questions related to menstruation covering the following topics- Hygiene & sanitation during menstruation, types of absorbent materials used, changing and disposing off absorbent material, house chores or physical activity done during menstruation, attending religious function or going to religious place or schools during menstruation & restriction or consumption of any particular food item. For all the questions, there was one correct answer and 1 mark was awarded for each correct answer and all the incorrect responses were marked 0. A maximum of 25 points could be attained in this section. The practice score was calculated thereafter. Table 1 shows the KAP questionnaire scoring.

Table 1
Knowledge, Attitude and Practice Score Classification

Classification	Standard Score (Min-Max)
Knowledge (6 Questions)	
Good	5-6
Fair	3-4
Poor	0-2
Attitude (5 Questions)	
Positive	16-25
Neutral	15
Negative	5-14
Practice (25 Questions)	
Good	18-25
Fair	9-17
Poor	0-8

Pretesting and Informed Consent: A face-to face interview technique was used to collect information on the proforma. Pre-testing of proforma was done on 5 adolescent girls (results not included in the study), necessary changes after pre-testing were done in the questionnaire. A written consent was taken from the parents of all the study subjects. They were also provided with a participant information sheet to understand the purpose of data collection. The adolescent girls were asked questions (by the researcher) based on their comfort, after assuring them that their data will be kept confidential.

Statistical Analysis: The study questionnaire data was entered into an Excel spreadsheet. All the statistical analysis was done using SPSS version 20. Qualitative data was analysed using

summary statistics such as frequency, percentage. The quantitative data was expressed as mean, standard deviation, minimum and maximum scores (knowledge, attitude and practice. Independent t-test was used to compare the energy and BMI of two groups (girls not restricting vs restricting any food during menstruation). Chi-square test was used to assess the association between BMI & SES and correlation test was used to assess correlation between variables like BMI & age of menarche, BMI & carbohydrate intake, BMI & fat intake and BMI & folic acid intake. Statistical significance was considered at $p < 0.05$.

Findings

Socio-Demographic Profile: The data revealed that the mean age of study subjects was 14 ± 1 years. They belonged to Hindu (85%), Muslim (11%), Christian (2%) and Sikh (2%) religions. With majority of them belonging to Upper middle income group (40%), 32% of study subjects belonged to lower middle and 28% were from upper lower income group.

Nutritional Status:

i) Anthropometric measurements: The mean height, weight and BMI for the study subjects has been depicted in Table 2. The Mean BMI of study subjects was $19.59 \pm 2.91 \text{ kg/m}^2$.

Table 2
Anthropometric Measurements of Subjects

Parameters	Mean $\pm$ SD (N=100)
Height (m)	1.52 ± 0.05
Weight (kg)	45.43 ± 8.47
BMI (kg/m^2)	19.59 ± 2.91

Height for Age classification: Majority of subjects (85%) were Normal (> -2 SD) as per the height for age classification of WHO (2007) while 15% subjects were stunted (< -2 SD).

BMI for Age classification: As depicted in Table 3, subjects were categorised into different grades of nutritional status based on WHO, BMI for Age classification (2007). It was seen that majority of the subjects were Normal while 16% were overweight and 3% were underweight.

Table 3
Distribution of Subjects according to BMI for Age Classification of WHO (2007)

Nutritional Status (BMI kg/m^2)	N=100
Severe Underweight (> -3 SD)	1
Underweight (-2 SD to -3 SD)	2
Normal ($+1$ SD to -2 SD)	81
Overweight ($+1$ SD to $+2$ SD)	14
Obese ($+2$ SD to $+3$ SD)	2

ii) Nutrient Intake: As depicted in Table 4, the nutrient intake of energy, protein, iron and folic acid is much less than RDA. The mean energy intake met 61.04 ± 10.22 % adequacy, protein intake met 93.98 ± 19.82 % adequacy, iron intake met 28.77 ± 10.83 % adequacy and folic acid

intake met $68.48 \pm 24.69\%$ adequacy. The correlation studies between BMI and nutrient intake show a good correlation between BMI and energy intake ($r=0.74$, $p<0.01$) while the correlation between BMI and protein intake is a positive weak correlation ($r=0.47$, $p<0.01$).

Table 4
Nutrient Intake of Study Subjects Compared with RDA (ICMR, 2020)

Nutrients	RDA	Mean $\pm$ SD (N=100)	% Adequacy
Energy (Kcal)	2400	1464.92 $\pm$ 245.20	61.04 $\pm$ 10.22
Protein (gm)	43	40.41 $\pm$ 8.52	93.98 $\pm$ 19.82
Carbohydrate (gm)	100 (Min.)	219.28 $\pm$ 49.14	RDA not available
Fat (gm)	-	38.26 $\pm$ 9.86	RDA not available
Iron (mg)	30	8.63 $\pm$ 3.25	28.77 $\pm$ 10.83
Folic acid (mcg)	245	167.79 $\pm$ 60.49	68.48 $\pm$ 24.69

Menstruation Background: Table 5 depicts the menstruation background of the study subjects. The mean age of menarche in the study subjects was 12 ± 1.58 years. Half of the subjects had menstrual blood flow for 3 to 5 days. The average length of menstrual cycle was 24.5 ± 8.81 days. 39 per cent subjects experienced painful periods, 24 per cent experienced heavy bleeding and 20 per cent had scanty bleeding. Maximum subjects were informed by their mother / sister about menstruation. Maximum subjects searched the internet to gain information about menstrual hygiene and sanitation. The correlation studies between BMI and age of menarche showed a negative weak correlation ($r= -0.29$, $p < 0.01$) which means that as the BMI is increasing the age of menarche is decreasing.

Table 5
Menstruation Background of Subjects (N=100)

Menstruation Background		%
Age of Menarche (years)	10	8
	11	22
	12	30
	13	35
	14	5
Duration of Menstrual Blood Flow (days)	Less than 3	13
	3 to 5	50
	More than 5	30
	Sometimes more, sometimes less	7
Interval between two menstruation cycles (days)	15	15
	20	13
	28	60
	>35	12
Menstruation problem faced	Painful periods	39
	Inter-period bleeding	18
	Scanty bleeding	20
	Heavy bleeding	24

	Painful & Heavy bleeding	5
	Painful & Scanty bleeding	3
	Inter-period & Scanty bleeding	1
	Painful, Inter-period & Heavy bleeding	2
Who informed about menstruation?	Mother/Sister	70
	Friends	8
	Teacher	12
	Mass media	2
	Mother/Sister & Friends	1
	Mother/Sister, Friends & Teacher	1
	Mother/Sister & Teacher	1
	Other sources	5
Source of Information about menstrual hygiene	Radio	5
	Television	29
	Newspaper	3
	Television & Newspaper	1
	Internet	56
	Other sources	6

Knowledge, attitude and practice scores: Table 6 depicts that majority of subjects had good to fair knowledge regarding hygiene and sanitation, disposal of waste material and food choices during menstruation. Regarding attitude 74 per cent of study subjects had a positive attitude towards hygiene practices, nutritious food consumption and taboos related to menstruation and 19 per cent subjects had a negative attitude towards these factors related to menstruation. Majority of subjects had fair to good practices related to personal hygiene, sanitation and food choices related to menstruation. The correlation studies between knowledge and practice reveal a weak positive correlation ($r=0.23$, $p<0.01$).

Table 6
Distribution of Subjects according to Their Knowledge, Attitude and Practice Score

Category	Score	Total (N=100)	Mean±SD (Mini- Max)
Knowledge			4.35±1.27 (0-6)
Good	5-6	50	
Fair	3-4	38	
Poor	0-2	12	
Attitude			16.81±2.44 (10 - 22)
Positive	16-25	74	
Neutral	15	7	
Negative	5-14	19	
Practice			

Good	18-25	40	15.01±2.05 (10-20)
Fair	9-17	60	
Poor	0-8	0	

Food Choices related to Menstruation: Of the 100 subjects, 44 per cent girls were not having any restriction and 56 per cent were restricting certain food items as is depicted in table no. 7. Maximum subjects (30%) were restricting sour foods like pickles and tamarind during menstruation. Surprisingly, the energy intake of adolescent girls avoiding certain foods during menstruation (n=56) vs adolescent girls not restricting any food during menstruation (n=44) was similar (1450±217.15 kcal vs 1476V±266.55 kcal, p=0.604). The BMI of these two groups was also found to be similar (19.4±2.7 vs 19.7 ± 3.0, p =0.575).

Table 7

Frequency Distribution of Food Items Restricted during Menstruation among the Study Subjects (N=100)

Food items restricted	(n%)
Sour foods (Tamarind, Pickles)	30
Spicy foods	5
Hot foods (Milk, Tea & Coffee)	5
Cold foods (Curd)	3
Chocolates	1
Fast & oily foods	7
Cold & sour foods (Curd, Pickles)	7
Eggs & Dry fruits	2
Bitter & sour foods	1

Myths & Misconceptions related to Menstruation: Majority of subjects (89%) were prohibited from touching pickles during menstruation while 86% were prohibited from watering Tulsi plant and 57% were restricted from entering or cooking in the kitchen.

Association between SES and Nutritional status: As depicted from table 8, there is an association between SES & nutritional status of study subjects (p-value=0.03). It was observed that as the socioeconomic status increased the prevalence of overweight also increased. There were 9 subjects who were overweight in upper middle strata. Similarly, cases of normal nutritional status also increase with increasing SES. There are 31 subjects in upper middle strata, 27 in lower middle strata and 23 in upper lower strata. Only 3 subjects in the study population were underweight and they belonged to upper lower socio economic status. Thus we can infer that as the socio-economic status decreases the prevalence of underweight increases.

Table 8

Association between SES and Nutritional Status among the Study Subjects (N=100)

SES Class	BMI for Age			p-value
	Underweight (N=3)	Normal (N=81)	Overweight (N=16)	
Upper Middle	0	31	9	

Lower Middle	0	27	5	0.03
Upper Lower	3	23	2	

Discussion

Adolescence is an age of opportunity as it has physiological, psychological, social and emotional adaptation. The first menstruation is usually a distress and trauma for young girls because it occurs without her knowledge. This can lead to many misconceptions brewing in the mind of girls and result in adverse health outcomes. An accurate and timely intervention about reproductive & sexual health with regards to menstrual practices can help this vulnerable group to enhance their knowledge, change their attitudes and empower their decision making skills about themselves. A well-educated girl can manage her sanitation and hygiene very well and can save herself from any reproductive infections in long run^{5,8-10}. Therefore, in the present study we evaluated the Nutritional status, KAP about menstruation, menstrual health and hygiene practices, food choices and myths & misconceptions during menstruation in adolescent girls. In general, the total attitude in terms of menstruation was at a relatively positive level; however, majority had good knowledge of menstruation and menstrual hygiene and had consequently, fair practices in this regard.

The mean age of menarche in the present study was 12 ± 1.58 years which is similar to the study done in Saudi Arabia¹¹ where the mean age of menarche was reported to be 12.41 years.

In studies conducted by Shah¹² and Haque^{12,13} two-thirds of the girls knew about menstruation before menarche. In the present study, 70 per cent of the total subjects were first informed about menstruation by their mother or sister similar to study done by Tundia¹⁴. In the present study maximum subjects (56%) used internet to learn about menstrual hygiene and sanitation. The mass media play a prominent role in the dissemination of reproductive health information including menstruation¹⁵.

The Mean BMI of majority of subjects (81%) in the current study fall in normal range while the prevalence of overweight was 16 per cent. In a study done in Saudi Arabia¹⁶ the prevalence of obesity was 26 per cent and 50 per cent subjects had normal BMI. In a similar study by Al-Awadhi and colleagues¹¹ the prevalence of obesity and overweight was 18.3 per cent and 25.8 per cent, respectively.

In the present study, mean energy intake met 61.04 ± 10.22 per cent adequacy. Whereas in a study conducted by Mohammadi¹⁷ overall dietary habits were found to be unsatisfactory. In our study energy intake and BMI shows good correlation. It does not reflect the current nutritional status, as the dietary intake is recorded for two or three days only and BMI is a reflection of the weight and height status over a period of time. Therefore, a good correlation does not necessarily mean that BMI is influenced by the current diet.

In our study majority of subjects had good knowledge related to menstruation and menstrual hygiene. Waldelen and colleagues from Brazil have reported 57.6 per cent participants had poor knowledge of menstrual hygiene¹⁸. Likewise, Abioye Kuteyi and colleagues from Nigeria have reported majority (60%) had appropriate knowledge about their menstrual period and, therefore, practiced well in this regard¹⁹. The attitude of majority (74%) of subjects was in the positive

category while 19 per cent had a negative attitude regarding menstruation. These findings are in line with the results of several other Indian studies²⁰⁻²². In the present study 60 per cent subjects had fair practices and none of the subjects had poor practices related to menstrual hygiene, sanitation and taboos. In a similar study done in Delhi it was reported that personal hygiene practices were found to be satisfactory in more than 90% of women²³. According to NFHS-5 (2019-2021), there has been an upgradation in using hygienic methods during menstruation among 15-24 years of age women from 58 per cent in NFHS-4 to 78 per cent.

In the present study adolescent girls were restricted from entering/ cooking in the kitchen and also were restricted from watering Tulsi plant during menstruation. Similar findings were reported in studies conducted in India^{25,26} and Iran²⁴ where 58.8 per cent adolescent girls were restricted from doing household work and 32.9 per cent were restricted from going to school. Whereas in a study by Goel., 16 per cent subjects disagreed that a women can enter or cook food during menstruation²³. In our study we found that 30 per cent adolescent girls were restricted from having sour foods like pickles and tamarind during menstruation. Similar results were reported by Sharma and Colleagues²⁷ where they reported that 52 per cent females were restricted from having sour foods.

Correlation studies revealed a good correlation between BMI and energy intake ($r=0.74$, $p<0.01$). Therefore, it can be said that as energy intake increases, the BMI also increases in the study subjects. The correlation studies between knowledge and practice reveal a weak positive correlation ($r=0.23$, $p<0.01$), which means that good knowledge will not necessarily result in good practice. It was also reported that subjects with a higher BMI attained Menarche at an earlier age ($r= -0.29$, $p<0.01$). Therefore, we can say that adolescent girls with a higher BMI attain menarche early. In a similar study by Al-Awadhi¹¹ it was reported that there was a significant inverse association between age at menarche and obesity or overweight. Significant association was observed between BMI and Socio-economic status ($p<0.03$) which means that as the Socio-economic status increases the BMI also increases and vice-versa.

Conclusion and Recommendations

In the present study, the nutritional status of 4/5th of adolescent girls belonging to middle income group were in the normal range. A similar trend was seen for height for age being normal in the study population. Dietary intakes of energy, iron and folic acid was inadequate but protein intake was normal when compared with RDA. The knowledge and practice score related to menstrual health & hygiene of majority of girls was in the good to fair category. Approximately half of the girls had some or the other food fads and restrictions during menstruation.

Keeping in view the results of the present study, a longitudinal study using larger sample sizes and including mothers along with adolescent girls in particular, would be recommended. More attention should be paid on nutritional guidance among adolescent girls for healthy outcome of future generations. Health education sessions regarding menstrual health and its food choices should be conducted in schools and colleges and also in communities. It can also be included as part of School Health Programmes.

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Neural Network Approach for Diabetes Prediction on PIMA Indian Women

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Abstract

Diabetes Mellitus is a chronic medical condition related to metabolic disorder resulting in hyperglycemia (High Blood Glucose). The chronic nature of diabetes further leads to complications like cardio vascular diseases, neural disease, kidney failure, etc. The availability of Artificial Intelligence algorithms has facilitated for effective and accurate diabetes prediction. Existing approaches inherit complex architectures leading to time and complexity overhead. This paper presents a light weight, less complex yet effective Neural Network approach for diabetes prediction among PIMA Indian Women. This paper studies and investigate the diagnostic measures based binary classification of patient record using PIMA Indian Diabetes dataset. The proposed neural network approach achieved 76 per cent accuracy for diabetes prediction. Also, the diagnostic measure correlation findings suggest that glucose is most significant diagnostic measure for diabetes prediction.

Key words: Diabetes Mellitus, Neural Network, Health, Machine Learning, Diagnostic Measure, Medical

Introduction

With the latest development of Artificial Intelligence (AI) techniques, medical imaging domain has experienced significant potential in enhancing the technology driven diagnosis, analysis, prediction and treatment. The tedious task of understanding the patient medical data traditionally required extensive medical expert analysis and interpretation. However, Machine Learning (ML) algorithms has eliminated the manual effort overhead of understanding the patient medical data with even excellent accuracy and quantitative performance. Among other medical conditions, diabetes mellitus remain one of the chronic medical condition affecting the insulin levels in human body. In simplistic terms, the insulin hormone regulates the blood sugar level and the critical blood glucose levels can lead to damage of human body systems, specifically nerves and blood vessels. This conditions if left untreated can be fatal and requires timely prediction and prompt treatment.

The diabetes prediction based on multiple diagnostic measures (data features) requires identification of data patterns through a machine learning model. The machine learning models accurately identifies a pattern and predicts the new sample with high accuracy. In recent past, several research works have focused on machine learning based solution for diabetes prediction. However, most of these existing works involves complex architecture and increases time

complexity to train the model. Despite their good performance, these complex models and architecture bring time, space and complexity overhead. To overcome these complexities, this paper presents a less complex neural network architecture with less time complexity. The human body metabolism varies significantly depending on environmental conditions, geographical location, lifestyle, gender and other factors. Thus, the medical condition, severity and disease diagnosis can change based on above mentioned conditions/ factors.

This paper presents a diabetes prediction approach based on multiple diagnostic measures using less complex and less time consuming neural network architecture. This paper specifically predicts the diabetics among Pima Indian women above 21 years of age. The motive of this paper is to study and understand the prevalence of diabetes in Pima Indian women group (above 21 years of age) and develop prediction model for diabetes detection. The diabetes prediction task is transformed into binary classification task (diabetic and non-diabetic) using neural network.

The remaining paper is divided into 07 sections such that the related works are discussed in section 2, the dataset used is discussed in section 3, the methodology is presented in section 4, the results and findings are highlighted in section 5, the conclusion is presented in section 6 and the future recommendations of this paper are discussed in section 7.

Literature Review

Song et al. (2024)¹ explored the diabetes risk assessment through Bayesian networks. They utilized acyclic graph representation for joint probability distribution and tabu search, search algorithm for global optimization making the system complex. Looker et al. (2023)² presented a criteria based type 2 diabetes review paper focusing on diabetic kidney disease. Melsom et al. (2019)³ investigated the correlation between Glomerular Filtration Rate (GFR) baseline, Norwegian adults and Pima Indians. Hayashi and Yukita (2016)⁴ combined recursive rule algorithm, J48graft and methods for sampling selection to build classification rules or diabetes diagnosis on Pima Indian diabetes dataset. Pavkov et al. (2005)⁵ studied the effect of kidney disease and Jimenez-Corona et al. (2006)⁶ studied cardiovascular disease prediction on Pima Indians considering the presence and absence of Type 2 diabetes. Lekkas and Mikhailov (2010)⁷ reviewed fuzzy rules and fuzzy classification for medical diagnosis over Pima Indians. Pettitt et al. (1997)⁸ analyzed the association between breastfeeding and diabetes in Pima Indians. Charles et al. (1994)⁹ analyzed the correlation between obesity, gravidity and diabetes in Pima Indian females. Reza et al. (2024)¹⁰ considered ensemble technique for diabetes classification on Pima Indian diabetes dataset. The ensemble technique uses a combination of multiple algorithm and hence brings a complexity and time overhead. Lee et al. (2010)¹¹ proposed an expert system based on fuzzy logic for application of diabetes decision support and goncalves et al. (2006)¹² proposed hierarchical neuro fuzzy inverted system for diabetes classification. Kala et al. (2010)¹³ compared intelligent systems for diabetes prediction on Pima Indians using hybrid approaches and S. et al. (2024)¹⁴ recently proposed a hybrid convolutional approach for diabetes prediction by combining features from multiple models. Karatsiolis et al. (2013)¹⁵ implemented support vector machine for diabetes prediction on Pima Indians. Kanthonga et al. (2024)¹⁶ studied the impact of number of features on result of diabetes prediction model based on deep learning paradigm.

Dataset

To study and implement diabetes prediction on Pima Indian women, this paper uses Pima Indian Diabetes (PID) dataset [21]. The dataset is prepared by National Institute of Diabetes and Digestive and Kidney Diseases. The dataset includes a total of 768 samples (rows) and numerical values. The Pima Indian Diabetes dataset includes 9 columns (incorporating 8 features and 1 target variable) and 768 data row entries as shown in Table 1.

Table 1
Sample Data Distribution of PIMA Indian Diabetes Dataset

Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age	Outcome
6	148	72	35	0	33.6	0.627	50	1
1	85	66	29	0	26.6	0.351	31	0
8	183	64	0	0	23.3	0.672	32	1
1	89	66	23	94	28.1	0.167	21	0
0	137	40	35	168	43.1	2.288	33	1

Feature Distributions

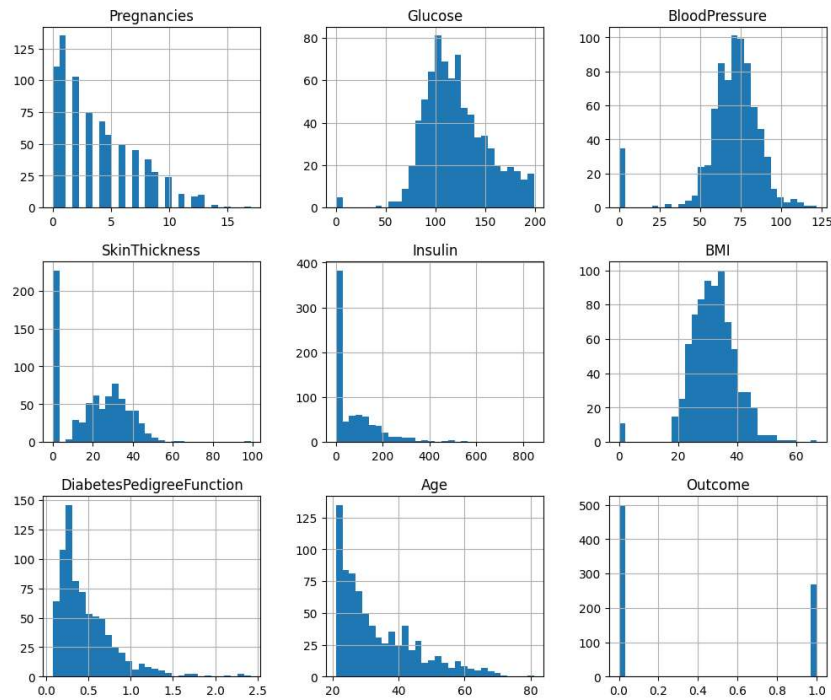


Figure 1
Feature Distributions of PIMA Indian Diabetes Dataset

The individual feature distributions of each diagnostic measure of PIMA Indian Diabetes dataset is presented in Figure 1 (depicting total 09 graphs out of which 08 are diagnostic measures and Outcome is the target variable).

Figure 2
Relationship between Diagnostic Measures of PIMA Indian Diabetes Datasets



The analysis of Figure 2 highlights the relationship between each pair of diagnostic measures of PIMA Indian Diabetes dataset.

Methodology

The methodology incorporates stepwise training of machine learning based neural network architecture for diabetes detection. The neural network architecture model uses Pima Indian Diabetes dataset¹⁷ which contains data of study conducted on females of Pima Indian heritage aged 21 and above.

The methodology entails loading the dataset followed by data pre-processing. The processed data is then forwarded to sequential neural network for model training. The trained model with

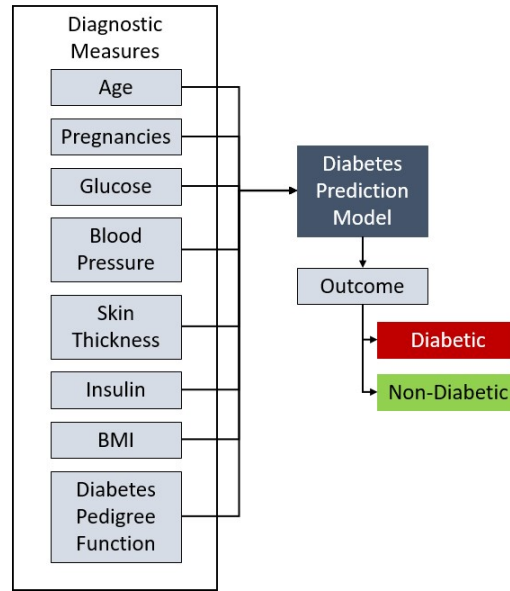
known data patterns from 08 diagnostic measures (features) predicts the new sample (other than training) into diabetic or non-diabetic (as shown in Figure 3).

The dataset is loaded in CSV format and designated columns are assigned for each feature. The data preprocessing involves standardization of features on same scale by removing mean and scaling to unit variance such that

$$z = \frac{(x - \mu)}{\sigma} \quad (1)$$

where, x denotes original feature, μ represents feature mean, σ denotes standard deviation of feature and z represents the transformed feature.

Figure 3
Diagnostic Measure-based Diabetes Prediction Approach



The internal architecture of neural network includes sequential organization of three dense layers and two dropout layers between each dense layer (as shown in Figure 4). Among three dense layers, the final dense layer represents the output layer and is triggered by sigmoid activation function given by:

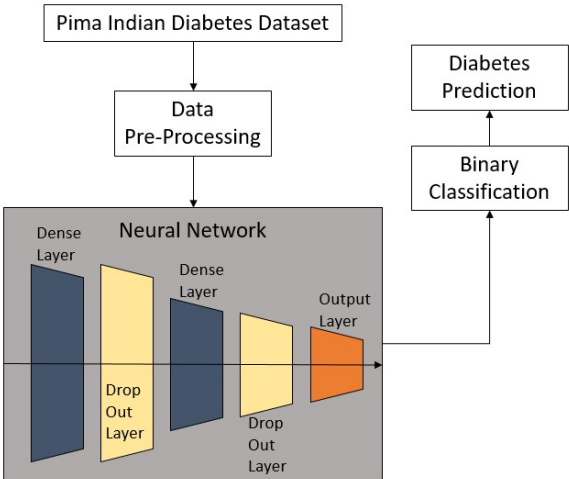
$$\text{Sigmoid}(i) = \frac{1}{1 + e^{-i}} \quad (2)$$

where, i denotes the input (logits) to the *Sigmoid* function and e represents the base of natural logarithm (≈ 2.718). The first two dense layers are targeted by ReLU activation function. The dropout layer uses a dropout rate of 0.5 to prevent model overfitting.

The Neural Network model is then compiled with Adam Optimizer to adjust the learning rate for each parameter to minimize loss function (binary cross entropy in this case). The detailed architecture of neural network entailing dense layer, dropout layer and output (classification) layer

can be observed in Figure 4. The final classification layer is responsible for binary classification task of diabetes prediction.

Figure 4
Architecture of Neural Network based Diabetes Prediction Model

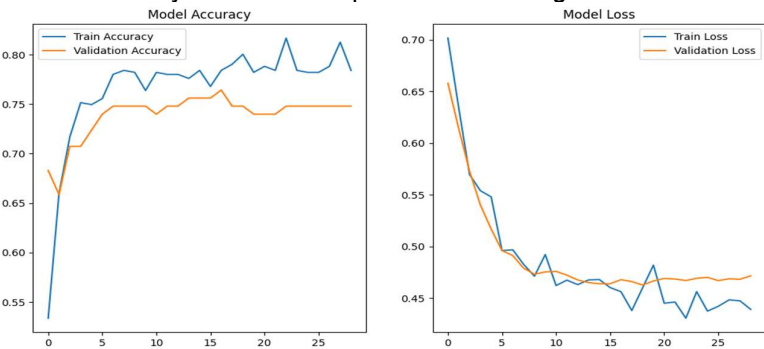


The model is trained over 100 epoch cycle. The final trained model shows accurate prediction of diabetes over new data samples (testing set) which confirms the generalization ability of the model.

Findings

This section presents the result of Neural Network based diabetes prediction on Pima Indian Women and also discusses and identifies the most significant diagnostic measure (feature) for diabetes prediction. The quantitative performance results are presented on the basis of precision, recall, F1 score, and accuracy respectively.

Figure 5
Accuracy and Loss Graphs while Training the Model



The analysis of Figure 5 reveals that the model training stop after 29 epochs despite the model setting as 100 epochs. This early stopping is possible due to incorporation of early stopping parameter in our model to prevent over fitting and save computational resource (training time). The patience value for model is set as 10, which means the model will observe validation loss and if does not improve for 10 consecutive epochs, the training will stop.

Figure 6
Neural Network Model Diabetes Prediction Result

	precision	recall	f1-score	support
0	0.82	0.81	0.81	99
1	0.66	0.67	0.67	55
accuracy			0.76	154
macro avg	0.74	0.74	0.74	154
weighted avg	0.76	0.76	0.76	154

The results displayed in Figure 6. highlights the overall accuracy of 76% for prediction of non-diabetic (represented by 0) and diabetic class (represented by 1).

Figure 7
Performance Comparison on Pima Indian Diabetes Dataset

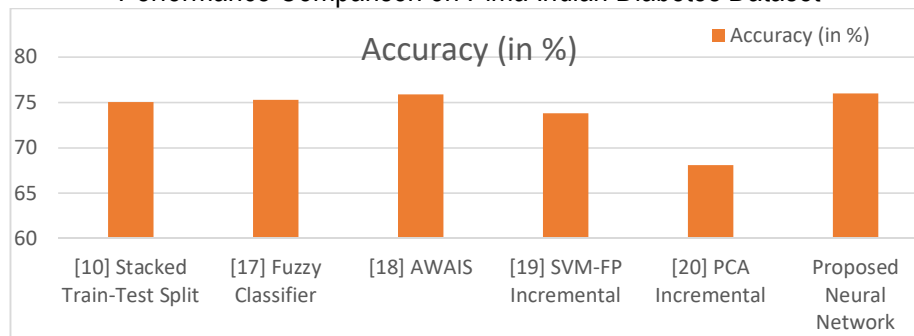


Figure 7 presents a comparative analysis of performance comparison of proposed neural network model with existing related works on Pima Indian Diabetes dataset on the basis accuracy evaluation metric. The proposed neural network model clearly outperforms the highlighted works in Figure 7.

Figure 8
Confusion Matrix of Diabetes Prediction Model (0: Non-Diabetic, 1: Diabetic)

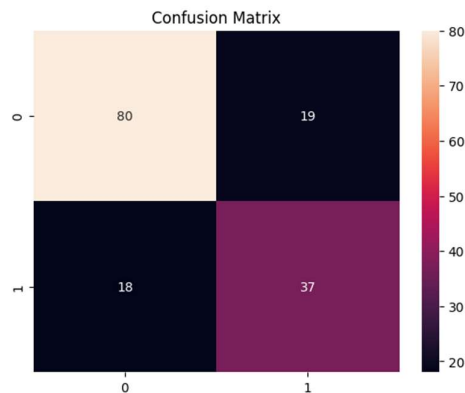
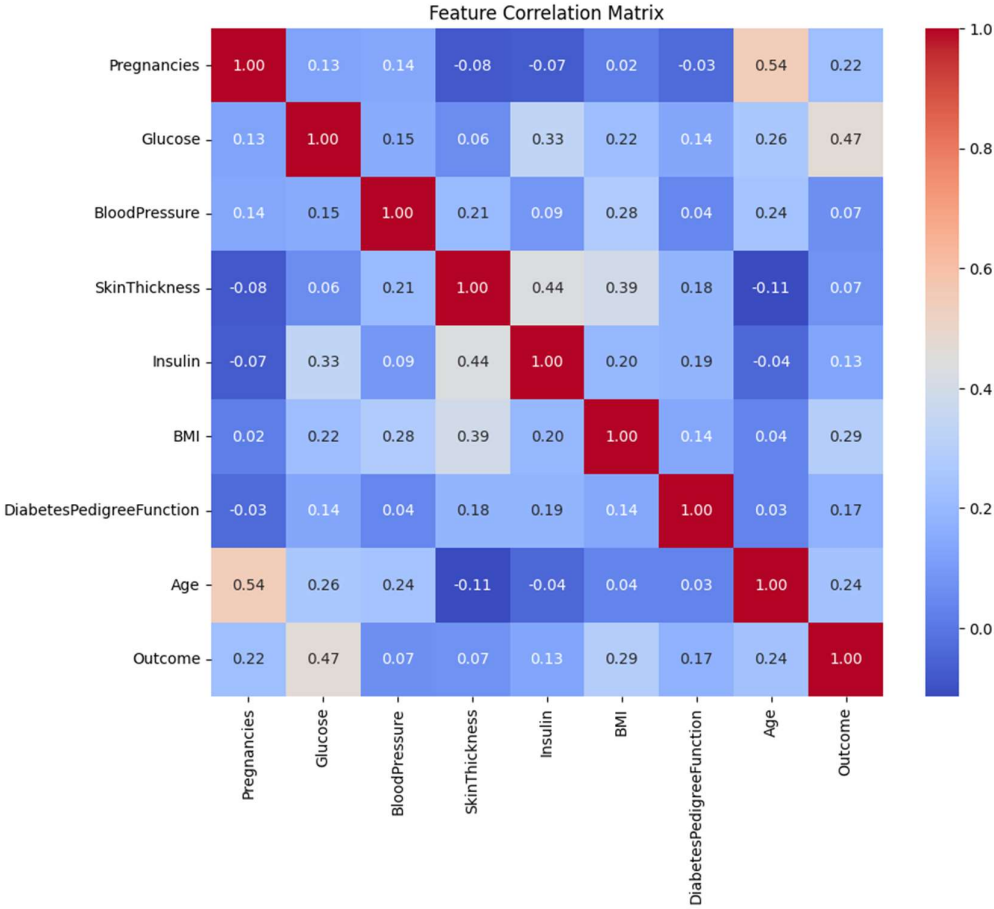


Figure 8 presents a confusion matrix of our neural network model for diabetes prediction. This confusion matrix presents a relation between actual ground truth values (represented by rows) and the predicted values (represented by column) of our model. The higher values in the diagonal

shows that the non-diabetic predictions (represented by 0 column) of our model shows correct prediction over 80 instances of actual samples for non-diabetic class (represented by 0 row) and similarly 37 correct predictions or class 0 (diabetic).

Figure 9
Feature Correlation Matrix of Pima Indian Diabetes Dataset



The proposed Neural Network model achieves 76 per cent accuracy for diabetes prediction on Pima Indian Diabetes dataset. However, the most important part of this experiment and study is to identify the most significant feature (diagnostic measure) which highly influences the diabetes prediction. Figure 9 presents feature correlation matrix among different diagnostic measures (08) and outcome (diabetes prediction). The analysis of Figure 9 clearly indicates that the most significant feature (diagnostic measure) for diabetes prediction is “Glucose” with a correlation score of 0.47 or 47 per cent.

Conclusion

Diabetes Mellitus is a chronic metabolic health conditions instigating hyperglycemia (High Blood Glucose Level). This condition impairs carbohydrate, fat and protein metabolism even resulting in fatal cardio vascular, neural, renal and other diseases and hence requires timely prediction and prompt treatment. The diabetes prediction based on multiple diagnostic measures (data features) requires identification of data patterns through a machine learning model. Most of the existing works rely on complex and time consuming models for diabetes prediction. This paper

presents a less complex and less time consuming neural network based model for effective diabetes detection among PIMA Indian Women. This paper also studies and investigates the individual diagnostic measures and their relationship with each other and the outcome (target variable). The proposed neural network model is grounded on sequential architecture of dense layers followed by dropout layers to prevent the model over fitting. The model also involves early stopping mechanism which saves the model training time and stops the model training if training loss is not improved. The quantitative performance results are presented on the basis of precision, recall, F1 score, and accuracy respectively. The result analysis highlights the good performance of the model with 76 per cent accuracy over PIMA Indian Diabetes dataset. Also, the diagnostic measure correlation findings suggest that glucose is most significant diagnostic measure for diabetes prediction.

Recommendations

Considering the effective prediction capability of proposed neural network model on diabetes prediction on PIMA Indian women, the model can be extended and trained for effective prediction of multiple diseases to uncover the data patterns, feature relationship (correlation) and assist further future investigations and studies related to Artificial Intelligence based diseases prediction.

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A Systematic Review on Psychosocial Journey of Parents Raising a Child with Autism Spectrum Disorder: Challenges, Resilience and Support

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Abstract

The substantive psychosocial challenges involved in raising an autistic kid immensely affect the emotional, social, and financial health of its parents. As if parenting was not tough enough to begin with, problems such as societal judgment and supply limits through the system can place yet more anxiety and depression in the minds of caregivers. The aim of the present literature review is to review and collate the socioeconomic views of parents whose children suffer from autism spectrum disorder (ASD), along with the challenges they face, the coping strategies adopted by the families, and the support systems that are available. From the seven electronic databases, namely Scopus, Science Direct, PubMed, Cochrane, Google Scholar, PsycINFO, and Web of Science, qualitative studies between 2014 to 2024 were searched. Criteria focused on the psychosocial concerns regarding parenting children with ASD-challenges, resilience, and support. The result found was psychological distress-stress, anxiety, and depression-as parents' experience social isolation, marital strain, and economic pressures. The needs of caregivers often evoke guilt, helplessness, and frustration. Amidst the latter, however, parents also show resilience by drawing on coping strategies, social support networks, and professional support. The findings suggest the need for a comprehensive framework that incorporates psychosocial supportive services, financial support, and other supportive measures of society to cater to this vast gamut of psychological contingencies of the parents raising their children with ASD. Awareness needs to be developed, and stigma needs to be reduced if the psychosocial well-being of these families is to be enhanced. Parents dealing with the challenges related to the care of a child with ASD would find useful information from this review that may be used in the design of future legislation, measures, and neighborhood-based support systems.

Key words: Autism Spectrum Disorder (ASD), Parents, Challenges, Social support.

Introduction

Autism spectrum disease, more popularly referred to as ASD, is a neurological disorder in which people are incapable of having a more efficient social interaction, communication, and behavior (Hodges et al., 2020). Autism spectrum disorder is a lifelong disability with negative implications on social interaction, language, behaviour, and relationships. The children diagnosed with ASD face difficulties in joint attention, recognizing relationships, grasping communicative actions, eye

contact, controlling chaotic behaviors, and creativity and adaptability deficiency (Sano et al., 2021). They also have cognitive deficiencies.

Since every child is unique, raising a child with special needs or autism is not very easy. In this regard, Bashir et al. (2014) argued that factors leading to increased severity for women in families where children suffer from autism include the absence of informal and professional support, personal control reduction perceptions, and external societal unawareness. Besides the disease itself, the stigma within society burdens mothers with autistic children even more because of an inadequate understanding of the condition (Baba, 2014). Mothers with ASD had poorer psychological well-being and more reported stress than mothers without ASD, as observed in a study that compared mothers who had children with ASD.

It can be quite trying and exhausting to be the parent of a child with autism spectrum disorder, especially in countries which lack several support networks. According to many research studies, families which contain an autistic child have relatively high anxiety, depression, and illness levels (Fairthorne et al., 2015). Studies have also shown that parents of children with ASD have higher levels of stress and lower levels of well-being than the parents whose children had other behavioral impairments, such as Down syndrome, for example (Vohra et al., 2014). According to Thomas et al. (2016), a parent of any ASD child does not have one, but rather several problems, which may start with their child's improper and unsanctioned inappropriate surprise conducts, or emotional struggles, the intensity of autism manifestations, and the financial burden that come with the costs of treatment and schooling. Research studies have indicated that families of children with autism spectrum disorder (ASD) are facing the high levels of stresses, and peer support assists them in managing this type of stress (Ilias K, 2018).

This systematic review aims to investigate and consolidate the psychological experiences of families raising kids with ASD. The review will regard primary challenges, resilience characteristics, and supportive mechanisms that provide a basis for informing parents' experiences, focusing on the behavioural, social, and practical aspects of care. To this end, this study collates empirical qualitative studies published between 2014 and 2024 for the purpose of showing the mental challenges of parents caring for their children suffering from ASD.

Methodology

Taking into consideration the difficulties, strengths, and resources available to parents, this assessment will compile data on the psychosocial aspects of caring for children with autism spectrum disorder. Thus, in order to maintain a straightforward and comprehensive strategy for the choice and compilation of studies, the review will be carried out in accordance with the recommendations established by PRISMA Flow Diagram.

Search Strategy: The study will optimize literature search capabilities by various electronic databases like Scopus, Science Direct, PubMed, Cochrane, Google Scholar, PsycINFO, and Web of Science from the year 2014 to 2024. The search strategy will employ keywords concerning the topic, such as "ASD", "parents," "psychosocial impact," "challenges," "resilience," and "support systems." Specific alliances of Boolean operators such as AND and OR will combine these terms and would help in the identification of the relevant studies. Besides

this, the reference lists of the identified studies and grey literature will be searched to identify anything else relevant.

Inclusion and Exclusion Criteria: Inclusion criteria allow for the inclusion of studies in the review when the following conditions are met: (1) study population will be only the parents or caregivers of children diagnosed with ASD; (2) only qualitative designs are envisaged, namely, phenomenological, grounded theory, ethnographic, or case studies; (3) psychosocial aspects, such as challenges, resilience, coping strategies, and support mechanisms available for parents, should be under focus; (4) the articles published should be in English or available in English translation; (5) articles published from 2014 to 2024. In the presence of non-qualitative studies, focus on non-parent populations, discussions directed toward medical or educational interventions instead of psychosocial factors or articles published outside of the pre-defined period, exclusion would apply.

Selection Process: There will be two stages to the study selection process. The first step is to identify which papers do not fit the inclusion criteria by reviewing their abstracts and titles in the search results. Phase two involves retrieving and evaluating the complete text editions of research that may be eligible. Eliminating studies that did not meet the eligibility requirements following full-text evaluation would be the last step. When reviewers find inconsistencies, they may address or communicate with a third party to resolve the issue.

Data Extraction: A consistent pro forma will be used to gather data from the listed trials. Several researchs features, such as authors, publishing year, research spots, number of participants, and research techniques, would be the primary focus during collection. Major findings that deal with parental psychosocial challenges, resilience factors, and support mechanisms will also be recorded. The strengths and weaknesses of the research studies will be evaluated as part of the data extraction process.

Thematic Analysis

The data will be analysed thematically. Themes of psychosocial experiences of parents bringing up children with ASD would, therefore, span across published studies. To gain a comprehensive grasp of the difficulties, strengths, and resources that parents face, we will perform a synthesis of stories. A meta-synthesis, if warranted, would be performed to investigate common patterns and insights into the psychosocial journey of these parents. Identification of studies within similar themes would be key, and integrated summaries of findings will provide a comprehensive review of joint psychosocial effects of parenthood of a child with ASD.

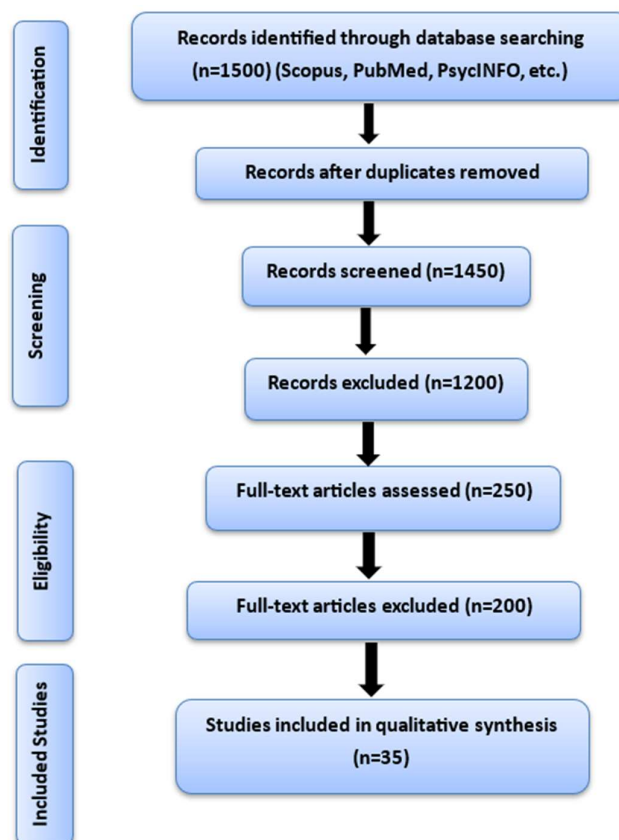
Quality Assessment: The qualitative study checklist developed by the Critical Appraisal Skills Programme (CASP) will be used to evaluate the papers that were considered for inclusion. This instrument will assess the validity of each study by looking at its methodology, sample, data collecting, and analytic procedures. Studies will be classified as high, moderate, or low quality based on these criteria.

A PRISMA flow can be used to visualize the process of selecting the study. The process will go as follows:

- **Identification:** A total of 1,500 records were identified across the databases, related to direct search and other sources.
- **Screening:** Thereafter, 1,450 records will be screened, on the basis of title and abstract, after removing duplicates. It can be estimated that around 1,200 records will be excluded in this stage because of irrelevance or failure to meet inclusion criteria.
- **Eligibility:** The full-text articles of about 250 studies will be assessed for eligibility; post this stage, 200 studies will be excluded for either non-qualitative research, not pertaining to the psychosocial focus at the moment, or simply due to other exclusion criteria.
- **Included Studies:** It is estimated that around 35 studies will be included in the qualitative synthesis.

To guarantee a comprehension of the socioeconomic conditions faced by parents parenting children with ASD, such techniques would lay the groundwork for meaningful and top-notch investigations in the review. The thematic synthesis would include insight into the common challenges, resilience factors, and support systems that constructively direct these parents' psychosocial journeys.

Figure 1
PRISMA Flow Diagram



Findings

Challenges in Raising Children with Autism: Students on the autism spectrum can benefit from intervention programs that focus on improving their academic performance,

developing adaptive language and interpersonal abilities, and reducing behavioral concerns so that they can become more self-reliant. As a result, parents of autistic children have a moral obligation to assist their children in developing independence by teaching them to speak, provide them with practical skills, and ensure their safety. In addition to informing their siblings about autism, they should make sure that none of their siblings feel resentful or jealous. Many parents on the autism spectrum deal with stress on a daily basis because of their children's problematic behaviour, their own overwhelming workloads, and the absence of social support (Gupta, 2020).

Psychological Challenges: The mental health of parents might suffer as a result of caring for a child with autism, a problem that is especially common in developing countries. According to Gupta (2020), parents whose children have autism are more prone to experience mental health disorders such as depression, anger, feelings of powerlessness, guilt, and self-blame. Children diagnosed with autism may exhibit repetitive behaviors and continue to struggle with social interpersonal relationships. Individuals on the autistic spectrum may display challenging and disruptive behaviors such as aggressive outbursts, suicidal thoughts, and inability to control their emotions. Behaviors such as aggression and self-injury are problematic. A higher risk for mental diseases may be associated with the heightened stress levels experienced by parents of kids with autism as opposed to parents of generally developing kids and caregivers of children with other disabilities, according to research (Sun and Heng 2024).

There may be a fourfold increase in the reported level of anguish among women whose kids are autistic compared to those whose kids don't suffer from the illness. Because of their children's inappropriate behaviour in public, parents of autistic children may also experience stigma, hostility, and shame (Bashir et al., 2014). In addition to those discussed above, other barriers to achieving career success are anxiety and the exorbitant cost of childcare, often linked to autism. Many parents of autistic children have mental health issues such as anxiety, depression, and OCD (Schnabel et al., 2020).

Rfat et al. (2023) established that parents with autistic children tend to have a higher risk of developing feelings of despair, anxiety, fatigue, and vulnerability. In the Egyptian context, Omar et al. (2017) reported the following about moms of autistic children whose concern about the future of their kid's well-being triggered numerous uncomfortable feelings: depression, wrath, tension, nervousness, and an anxious state. Other reasons that contributed to their psychological turmoil include their burden of duties related to caregiving, financial pressures, and also lack of communication with their autistic child. Some parents felt that their children are a financial burden, which has been exhibited by Acharya and Sharma (2021), while others feared after they were turned down by their husbands. According to Jackson et al. study conducted in 2018, teasing of the children by their classmates or the rejection by the children of parents' may cause depression.

Social Challenges: Autism spectrum disorder (ASD) is one of the neurodevelopmental disorders that significantly slows a person's growth in almost every area, including behavior, communication, and social activities, among many others. The challenges of developmental alterations in families whose children have ASD make family socialization even more daunting. According to Gobrial (2018), children with autism may not be able to engage in social calls or

play events. Omar et al. (2017) states that almost all parents avoid interacting with other families and relatives, which greatly impacts the communal lives of kids and households with generally young kids. Additionally, the majority of parents acknowledged having dealt with autism stigma, which encompasses unfavourable societal assumptions about people with disabilities and mental illness (Kinnear et al., 2016). Due to the difficulty in visiting loved ones who were compelled to stay home more often instead of venturing out, they experience social isolation as a result of this stigma. There was a decline in the number and quality of social connections among parents as well. Because they lack a reliable babysitter, they also dread going out to public or social activities, which makes them feel awkward (Gobrial, 2018). Because of their children's behavioural issues, they were unable to bring them to social events, and they had little time to engage with friends who did not share their concerns (Papadopoulos, 2021). On top of that, parents of autistic children sometimes struggle to form healthy relationships with their child's sibling(s) due to feelings of jealousy or unjust treatment (Gupta, 2020).

Marital Challenges: As a result of the child's autism, the family as a whole must adjust to a new normal that necessitates specialised care and treatment for the parents (Papadopoulos, 2021). Spousal strife is common among parents of autistic children (Gupta, 2020). Relationships within the family, particularly those between spouses, changed after a child's diagnosis of ASD, as they frequently explained. According to Sim et al. (2019), couples who are raising a kid with ASD commonly experience a decline in marital love due to the strain on their emotional connection. It's common for couples to experience a change in dynamic, heightened anger and conflict, and a diminution of time and energy spent on intimacy when caring for a kid with autism (Chan & Leung, 2020).

The majority of parents experienced emotional estrangement and a decline in their once solid relationships as a result of neglecting their spouse's needs. Increased stress and communication problems; uneven responsibility distribution; financial hardship owing to therapy, medication, and equipment costs; a dearth of social support; and divergent coping mechanisms, which can cause misunderstandings and arguments, are all possible problems that may arise in a marriage (Gupta, 2020). Withdrawal from social activities was an attempt by most parents with kids who had autism (Tavakol et al., 2019). The couple's relationship takes a turn for the worse when one or both parents refuse to understand or support the other and instead place blame on the other. Divorce rates are higher among couples with an autistic child compared to those without.

Financial Challenges: Family finances may take a hit when children with ASD are born. This financial issue is experienced by parents whose children have autism spectrum disorder. It can be difficult for low-income families to afford the specialised treatment, educational programs, assistive devices, and other supports needed for autistic children. Medical care, such as prescriptions and therapy could be expensive. High medical and therapeutic costs, most probable quits from the job, and loss of spouse would lead parents with children who have ASD to accept threefold higher financial aid (Befkadu & Adamek, 2022). To some families, the treatment provided for children who have ASD, by private groups or therapy centers could be out of the reach financially. Parents have to sacrifice quality medical care for their children in order to afford it. The reason is that, because of children's autism, some parents even lose jobs to care for their children (Matin et al., 2022). Such findings show that low-income families are

more susceptible to heightened levels of parent burnout because of financial stress and a desire for a second income in order to meet the expensive cost of special education and therapy interventions for autistic children (Montes & Cianca, 2014). The necessity for early action, as well as the difficulties associated with delayed or incorrect diagnoses, can impede professionals' ability to provide timely care and knowledge (Grasu, 2015). Gobrial (2018) notes that mothers with autistic children may have to make personal hardships, such as working more hours, quitting their jobs, or even holding down multiple jobs, in order to afford nursery.

Suggestions for Raising Children with Autism Spectrum Disorder

According to Roquette Viana et al. (2021), parenting is a significant life cycle phase that alters relationships and changes one's surroundings. As a result of societal stigma, barriers to specialized treatment, and behavioral issues, many parents struggle to parent a child diagnosed with autism spectrum disorder (Shattnawi et al., 2021). However, the journey becomes more challenging for parents who have to manage an autistic child because of the challenges they face both at their residence and in the community. Financial hardship, poor physical and mental health, and an increased likelihood of divorce are all issues that they face at home. Patients may face challenges such as having to pay out of pocket or driving great distances to reach treatment facilities while they are in the community. Further, issues that families with an autistic child may encounter can be varied: emotional, social, financial, physical, and behavioral types of problems (Elhawati, 2023). Raising a child with autism creates unique challenges that may affect both their mental health and child development - cognitive and physical. Among the psychological implications that parents experience due to their children needing them constantly and uncertainty about their own fate include stress, anxiety, depression, and isolation (Papadopoulos, 2021).

Research by Efstratopoulou et al., 2022 explains that the parents experience distress, and problems with communication arise as a result of the need for special care towards the autism spectrum disorder of their children. Regarding these obstacles, building a strong support system and seeing therapists that specialize in families with an autism spectrum disorder is essential (Shattnawi et al., 2021). It is a safe haven for the couple to discuss the issues and formulate solutions to mend them with the support of developing coping mechanisms. Clear tasks, support, and acknowledgment of accomplishments with regard to their care of someone with ASD help build a stronger bond while having to carry uneven obligations. Finally, in a bid to join down the wall of loneliness and instead create a network of support, the parents of children with ASD need to constantly interact with their spouse, extended family, or close friends (Roquette Viana et al., 2021).

According to the National Autistic Society (2023), parents can greatly benefit from maintaining connections with other parents through various means like as support groups, online forums, and local organisations. This will help them feel more connected to the autism community and provide them with emotional support. The success and satisfaction of homeschooling depends on the joint efforts of parents, communities, and educational institutions (Ahmad, 2020). It is essential for parents raising a kid with ASD to maintain open lines of contact with friends and relatives in order to prevent social isolation, judgement, and complications beyond the first worries about the child's development (Shattnawi et al., 2021).

It is imperative that the government prioritises healthcare, education, and other forms of social work so that parents may be assured that their children will receive services that are covered by insurance or government programs (Shattnawi et al., 2021). Parents experience stress, despair, anxiety, diminished family life quality, and diminished life satisfaction as a result of these behavioural issues (Meleady et al., 2020).

As a parent, you should be aware of your child's problematic behaviour (Gadow et al., 2008) and work to help them avoid or cope with unpleasant situations by avoiding or minimising their reactions (Brewer et al., 2017).

Resilience of Parents of Children with ASD

Parents can enhance their problem-solving skills and cultivate a healthy coping mechanism for stress by cultivating resilience. A significant stress buffer effect is provided by parents who are resilient, since they are less likely to suffer from depression and have greater self-efficacy in raising their children with autism spectrum disorder (ASD). It was previously believed that children's adaptability stemmed from the commonplace, daily human resources found in their bodies, brains, households, and social environments (Zhao & Fu, 2020). Resilience reduces negative reactions to crises and helps people adapt positively, which is great news for parents of children with ASD who experience adverse symptoms (Kartini et al. 2018).

Importance of Support

Feelings of shame, weariness, and terror accompany the prolonged moments of despair and hopelessness that parents endure, along with heightened worry for their children's future. This study's results shed light on the importance of social and emotional support for families dealing with a disabled kid. An additional piece of evidence regarding the crucial significance of support is what this study adds. As a means of coping with the emotional and practical challenges they faced on a daily basis, many parents sought out the help of loved ones and professionals in the field of mental health counseling in order to alleviate the burdens of caring for their disabled kid. It seems that the children's optimism, hope, and other positive emotions were bolstered by their parents' psychological and social assistance (Heiman, 2021).

Discussion

The presence of ASD in the child impose heavy psychological, emotional, and financial burden on the family. Such parents have greater levels of stress, anxiety, and depression arising from unpredictable behavior, communication challenges, and the long-term nature of the disorder. These emotional troubles are compounded by the social stigma of being associated by an autistic child, leading to isolation and withdrawal from social gatherings. Marital strain can occur for parents, where caregiving responsibilities cause conflict and decreased intimacy. For low-income families, therapeutic costs, special education, and ongoing care can impose a heavy economic burden, often requiring personal sacrifice in the form of quitting jobs or taking additional work.

However, many parents manage to display extraordinary resilience through coping strategies and support from their social networks. Access to mental health professionals, support groups, and peer networks are all critically relieving the support structure for families. The relatives, particularly a spouse, sharing in intentions of caregiving duties also affects such problems.

The findings highlighted the need for better provision of support, pertaining to healthcare and educational services and economic assistance. There is also much need for the reduction in stigma and promotion of the social inclusion of families with ASD. While the journey of parenting these unique children tends to be tedious, the rock-solid resilience of the parents and the strong support systems bring out the need for continued research and policy-making that will provide support to them.

Conclusion

This research highlights the many psychological difficulties that parents of autistic children confront, including significant monetary, interpersonal, and psychological burdens. Given that parents are often dealing with heightened stress, anxiety, and depression, as well as managing feelings of shame and guilt due to the societal stigma of autism, a fragmented social life, and exorbitant costs of treatment, the review highlights the crucial role that mental health services, social support, and financial security play in alleviating the burden on these families. Caregiving becomes much more challenging when the added burden of having an autistic kid causes marital problems and reduces social support networks. As the review points out, families are incredibly strong in their own right, drawing strength from a variety of resources and employing a wide range of coping mechanisms to face the difficulties of caring for a kid with autism spectrum disorder.

All these results point to a more important need for an altogether more comprehensive support model when dealing with the emotional and social issues related to the care of an autistic child. Such families ought to be fully supported through much better psychological care, financial assistance, and social support systems in their quest to contend with matters. Additionally, the review emphasizes the need to reduce stigma associated with autism to help the mental and emotional well-being of parents. That is why this review establishes the importance of lawmakers, healthcare providers, and society to support families with children having an autism spectrum disorder. Program development and policy formulation need to take this into consideration to provide them with the support and service they require in raising their kid to one's acceptance and care.

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Knowledge Regarding Hypertension and Diabetes Risk Factors among Beneficiaries Visiting a Primary Health Centre of New Delhi

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Abstract

The objective of this study was to assess the knowledge of beneficiaries visiting a selected Primary Health Centre (PHC) in New Delhi regarding the risk factors for hypertension and diabetes. This descriptive cross-sectional study was conducted at the Urban Primary Health Centre in Munirka, New Delhi, involving 150 beneficiaries over the age of 25. Data were collected using a semi-structured questionnaire. The study found that about 33 per cent belonged to the age group of 26-35 years, 55 per cent were female, 90% were married and only 7 per cent were graduates and above. All participants were aware of the diseases "diabetes" and "hypertension." When assessing knowledge of risk factors, only 56 per cent of the participants demonstrated above-average knowledge about hypertension risk factors, while 55.3 per cent had above-average knowledge about diabetes risk factors. Among hypertensive patients (34%), 60.8 per cent showed above-average knowledge of hypertension risk factors, while 66.7 per cent of diabetic patients (30%) had above-average knowledge of diabetes risk factors. With regard to knowledge on the prevention of hypertension and diabetes, study findings revealed that 70% of participants had above-average knowledge in this area. Based on these findings, the study concludes that there is a need to further improve beneficiaries' knowledge of hypertension and diabetes risk factors and the PHC should implement measures to enhance awareness and education on these topics when the beneficiaries approach the health facility for the services.

Key words: Knowledge, Non-communicable diseases, Hypertension, Diabetes, Risk factors, Beneficiary.

Introduction

Non- Communicable Diseases, also known as chronic diseases, are a major health problem globally¹. NCDs disproportionately affect people in low and middle-income countries. India is experiencing a rapid health transition with a rising burden of Non-Communicable Diseases surpassing the burden of Communicable Diseases accounting for around 60 per cent of all deaths. Among these, hypertension or high blood pressure and diabetes are a significant public health concern².

Hypertension is a chronic disease and an important risk factor for many cardiovascular complications. It is a condition where persistently blood pressure is elevated, and clinical benefit is obtained from blood pressure lowering^{3,16}. In the last few decades, Diabetes has emerged as a major health problem globally. Diabetes is a chronic disease that occurs either when pancreas

does not produce enough insulin or when the body cannot effectively use the insulin it produces⁵. Lifestyle has long been associated with the development of many chronic diseases and NCDs. Modifiable risk factors include unhealthy diets (excessive salt consumption, a diet high in saturated fat and trans fats, low intake of fruits and vegetables), physical inactivity, consumption of tobacco and alcohol, and being overweight or obese. Non-modifiable risk factors include a family history of hypertension, age over 65 years and co-existing diseases⁶. PHCs play a pivotal role in tackling the NCD burden by promoting preventive behaviours, providing early detection and intervention, managing existing NCDs and empowering individuals to take charge of their health⁹.

Given the rising prevalence of hypertension and diabetes in India, particularly in low and middle-income populations, there is an urgent need to address these conditions through effective public health strategies. This study is essential as it seeks to identify and analyse key risk factors, evaluate current intervention strategies at the primary healthcare level, and propose actionable recommendations to address the increasing burden of these chronic diseases.

Non-communicable diseases are a major public health concern globally, affecting both developed and developing countries. However, limited knowledge about NCD risk factors among individuals visiting PHCs can hinder effective preventive measures. The finding of this study could help in identifying knowledge gaps and areas where awareness raising efforts need to be focused. The study could contribute to the efforts to prevent and control NCDs.

Review of Literatures

A study conducted by Dr. Ankita Singh in 2019 on awareness of non-communicable diseases and their risk factors among young adult women in Delhi found inadequate knowledge of the risk factors of common NCDs among 54.8 per cent of the study subjects¹⁹. A study was conducted to assess the knowledge of risk factors and consequences of hypertension in a rural population in South India in 2019. The study found Knowledge of risk factors and consequences of hypertension in this disadvantaged population was poor. There was better knowledge of risk factors in some, but not all, people who were aware of having hypertension. Screening and targeted educational programmes are warranted in this population to improve health behaviours and reduce the consequences of hypertension¹⁸.

In a study in North Shewa zone, Oromia region, Ethiopia (2022) conducted to determine the level of adequate knowledge of NCDs and associated factors among adult residents revealed a high level of inadequate knowledge of NCDs despite its foundational ability in tackling the burden of NCDs¹⁴. Another study based in Nigeria by Samuel (2017) confirmed a knowledge gap on NCDs and their risk factors. The study emphasized the importance of population-based intervention strategies to bridge the knowledge gap and minimize the prevalence of risk factors ^[11].

General Objective of the Study

To assess the knowledge regarding Hypertension and Diabetes risk factors among beneficiaries visiting the selected PHC of New Delhi.

Specific Objectives

- To assess the knowledge among beneficiaries regarding the preventive measures Hypertension and Diabetes.
- To find the association of hypertensive and diabetic patients and their level of knowledge about hypertension and diabetes risk factors respectively.

Methodology

This descriptive cross-sectional study was conducted at the Urban Primary Health Centre (PHC) in Munirka, New Delhi, among 150 beneficiaries aged over 25 years, from May 16th to June 15th, 2024. Beneficiaries attending the outpatient department (OPD) with acute severe illness or those unable to communicate were excluded from the study. The PHC in Munirka was selected through purposive sampling, while systematic random sampling was used to select the study participants.

Data were collected using a semi-structured questionnaire after obtaining informed consent from all 150 participants. The questionnaire consisted of three parts. The first part gathered socio-demographic information, including name, age, gender, marital status, and education level. The second part of the questionnaire assessed participants' knowledge of hypertension, with six questions on risk factors such as family history, advancing age, high salt intake, obesity, chronic stress, and alcohol consumption, and two questions on preventive measures like regular physical activity and a healthy diet.

Similarly, the third part focused on diabetes, assessing the participants' knowledge of its risk factors and preventive measures. It included six questions on risk factors such as obesity, chronic stress, smoking, family history of diabetes, advancing age, and unhealthy diet, as well as two questions on preventive measures like regular exercise and a healthy diet. For every correct answer on the knowledge about hypertension and Diabetes risk factors and its preventive measures, a score of 1 was given to each beneficiary. Participants were also asked whether they had been diagnosed with hypertension or diabetes, and if so, whether they were receiving treatment and information from healthcare providers at the PHC regarding their condition and its potential complications.

Findings

Socio-demographic Profile of Beneficiaries Visiting the PHC

Table 1
Socio-demographic Profile of Beneficiaries Visiting the PHC

Socio- Demographic variables	Sub- groups	Frequency (N)	Percentage (%)
Age group	26-35	50	33.3
	36-45	38	25.3
	46-55	28	18.7
	56-65	28	18.7
	66 and above	6	4
	Total	150	100

Gender	Male	67	44.7
	Female	83	55.3
	Total	150	100
Marital status	Married	136	90.7
	Unmarried	12	8
	Widowed	1	0.7
	Divorced/ Separated	1	0.7
	Total	150	100
Education status	Illiterate	36	24
	Primary	41	27.3
	Secondary	24	16
	Senior Secondary	18	12
	Graduate	21	14
	Graduate and above	10	6.7
	Total	150	100

Table 1 indicates that about 33 per cent belonged to the age group of 26-35 years, 55% were female, 90% were married and only 7 per cent were graduates and above.

Knowledge about Hypertension and Diabetes risk factors and its preventive measures among beneficiaries visiting the PHC

Figure 1

Knowledge regarding Hypertension Risk Factors among Beneficiaries Visiting the PHC

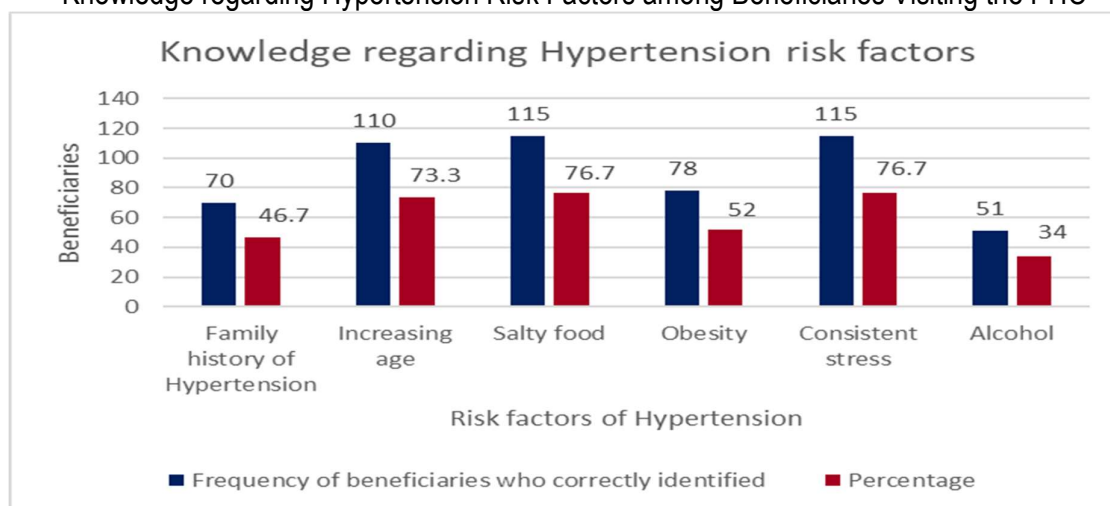


Figure 1 depicts the knowledge of study subjects on the risk factors of hypertension such as family history of hypertension (47%), increasing age (73%), more intake of salty diet (77%), obesity (52%), consistent stress (77%) and alcohol 34%)

Distribution of beneficiaries according to scores obtained for assessing knowledge about Hypertension risk factors

Table 2

Distribution of Beneficiaries according to Scores Obtained for Assessing Knowledge about Hypertension Risk Factors

Total correct answers about risk factors (score)	Frequency (N)	Percentage (%)
6	15	10
5	39	26
4	30	20
3	27	18
2	20	13.3
1	13	8.7
0	6	4
Total	150	100
Mean Score	$6*15 + 5*39 + 4*30 + 3*27 + 2*20 + 1*13 + 0*6 / 150 = 3.59$	

Table 2 indicates that the average knowledge score among the beneficiaries about Hypertension risk factors was 3.6. Accordingly, it may be inferred that about 56 per cent of the beneficiaries had above average knowledge while 44 per cent of the beneficiaries had below average knowledge about Hypertension risk factors.

Knowledge about prevention of Hypertension among beneficiaries visiting the PHC

Table 3

Distribution of Beneficiaries according to Scores Obtained for Assessing Knowledge about Prevention of Hypertension

Total correct answers about preventive measures (score)	Frequency (N)	Percentage (%)
2	105	70
1	25	16.7
0	20	13.3
Total	150	100
Mean Score	$2*105 + 1*25 + 0*20 / 150 = 1.57$	

Table 3 reveals that out of total 150 participants, 71 per cent responded that Hypertension can be prevented by regular physical activity and healthy diet while 28.7 per cent did not know which lifestyle choices help to prevent Hypertension. The mean score regarding the prevention of Hypertension among the beneficiaries was 1.57. It was found that 70 per cent of the beneficiaries had above average knowledge while 30 per cent of the beneficiaries had below average knowledge about prevention of Hypertension.

Knowledge about Diabetes Risk Factors among Beneficiaries Visiting the PHC

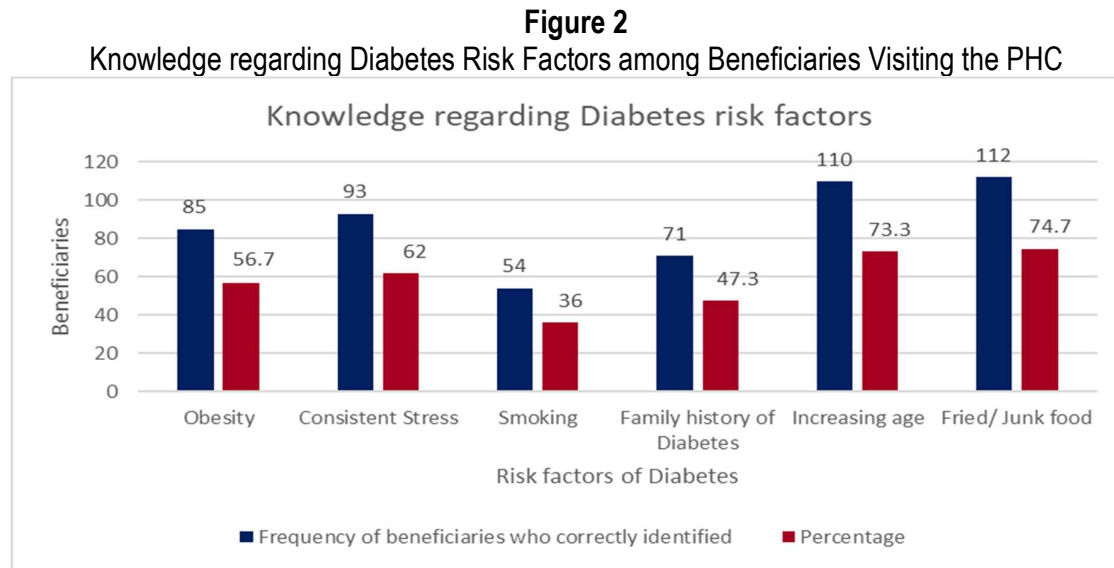


Figure 2 depicts the knowledge of study subjects on the risk factors of diabetes such as family history of diabetes (47%), increasing age (73%), obesity (57%), consistent stress (62%), smoking (36%) and intake of junk food (75%)

Distribution of beneficiaries according to scores obtained for assessing knowledge about Diabetes risk factors

Table 4
Distribution of Beneficiaries according to Scores Obtained for Assessing Knowledge about Diabetes Risk Factors

Total correct answers about risk factors (score)	Frequency (N)	Percentage (%)
6	19	12.7
5	33	22
4	31	20.7
3	19	12.7
2	24	16
1	16	10.7
0	8	5.3
Total	150	100
Mean Score	$6 \times 19 + 5 \times 33 + 4 \times 31 + 3 \times 19 + 2 \times 24 + 1 \times 16 + 0 \times 8 / 150 = 3.499$	

The average knowledge score among the beneficiaries about Diabetes risk factors was approximately 3.5. It was found that 55% of the beneficiaries had above average knowledge while 45% of the beneficiaries had below average knowledge about Diabetes risk factors.

Knowledge about Prevention of Diabetes among Beneficiaries Visiting the PHC

Table 5

Distribution of Beneficiaries according to Scores Obtained for Assessing Knowledge about Prevention of Diabetes

Total correct answers about preventive measures (score)	Frequency (N)	Percentage (%)
2	105	70
1	25	16.7
0	20	13.3
Total	150	100
Mean Score	$2*105 + 1*25 + 0*20 / 150 = 1.57$	

Out of total 150 participants, 70 per cent responded that Diabetes can be prevented by regular exercise and healthy diet and 29.3 per cent did not know which lifestyle choices help to prevent Diabetes. The mean score regarding the prevention of Diabetes among the beneficiaries was 1.57. It was found that 70 per cent of the beneficiaries had above average knowledge while 30 per cent of the beneficiaries had below average knowledge about prevention of Diabetes.

Table 6

Association of Hypertensive Patients and Their Level of Knowledge about Hypertension Risk Factors

Hypertensive Patients N (%)	Above average N (%)	Below average N (%)	p-value (Fisher's exact test)
51 (34)	31 (60.8)	20 (39.2)	0.251

It was found that out of 150 participants, 51 (34%) had Hypertension. Out of those having Hypertension, 60.8 per cent had above average knowledge and 39.2 per cent had below average knowledge about Hypertension risk factors.

Table 7

Association of Diabetic Patients and Their Level of Knowledge about Diabetes Risk Factors

Diabetic Patients N (%)	Above average N (%)	Below average N (%)	p-value (Fisher's exact test)
45 (30)	30 (66.7)	15 (33.3)	0.049

It was found that out of 150 participants, 45 (30%) had Diabetes. Out of those having Diabetes, 66.7% had above average knowledge and 33.3% had below average knowledge about Diabetes risk factors. A statistically significant association was found between diabetic patients and their level of knowledge about diabetes risk factors with a p-value of 0.049 which is less than 0.05.

Discussion

The study revealed that most beneficiaries were female (55%), married (91%), and educated to primary level (27%). All participants were aware of hypertension and diabetes. The average

knowledge scores were 3.6 for hypertension risk factors and 3.5 for diabetes risk factors, with 56 per cent and 55 per cent of beneficiaries having above-average knowledge of each, respectively. In terms of prevention, 70 per cent had above-average knowledge of preventive measures for both conditions. These findings contrast with Pooja Kansra's study in Punjab, which reported low awareness of diabetes preventability⁹.

The study also found that 34 per cent of beneficiaries had hypertension and 30% had diabetes. Among hypertensive patients, 60.8 per cent had above-average knowledge of risk factors, and 88.2 per cent were on treatment. Additionally, 90.2 per cent of those with hypertension received necessary information from healthcare providers. A study by Doreen Busingye in 2019 indicated poor knowledge of hypertension's modifiable risk factors in a rural South Indian population¹⁸. Among diabetic patients, only 66.7 per cent had above-average knowledge of risk factors, while 95.6 per cent were on treatment. Furthermore, 86.7% of diabetic patients received information from healthcare providers. Pooja Kansra's 2021 study also found inadequate knowledge of diabetes risk factors⁹. No statistically significant relationships were found between the variables in this study.

Conclusion

All study subjects were aware about hypertension and diabetes, but the knowledge of risk factors was limited. About 56% and 55% of participants had above-average knowledge of hypertension and diabetes risk factors, respectively. In contrast, knowledge about prevention was significantly better, with 70% of participants demonstrating above-average knowledge of preventive measures for both conditions.

The study concludes that there is a need to improve beneficiaries' understanding of diabetes and hypertension risk factors. The PHC should implement measures to enhance this knowledge and provide essential information on prevention and complications related to these conditions.

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Public Health Crisis of Road Accidents and Socio- Economic Determinants: A Cross Sectional Study from South Karnataka, India

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Abstract

Road traffic accidents rank as the eighth leading cause of death globally and represent a major public health concern. Belonging to a socioeconomically disadvantaged group exacerbates the risk of involvement in traffic accidents. This study aims to investigate the relationship between socioeconomic disparities and traffic accidents in Karnataka, India. A cross-sectional, mixed-methods study was conducted, analyzing data on road accidents that occurred between 2018 and 2022 in selected districts of Karnataka. Data were obtained from local police records, encompassing a total of 4,998 cases. Binomial logistic regression was employed to examine the influence of low socio-economic determinants on road crashes. The Hosmer-Lemeshow test indicated a strong correlation between low levels of education and road accidents ($p = 0.21$). Similarly, unskilled occupations showed a significant association with crash rates ($p = 0.01$). Both young and elderly individuals experienced higher mortality rates compared to other age groups. Additionally, prolonged poverty, social exclusion, and deprivation were significant risk factors, making marginalized castes particularly vulnerable to road accidents. Socio-economic disparities, including education, occupation, and caste, significantly contribute to an elevated risk of road traffic accidents. These factors are closely linked to social exclusion and disadvantage. Targeted community engagement and interventions tailored for drivers and vulnerable populations from underserved communities are recommended to mitigate this issue.

Key words: Socio-economic, Inequalities. Deprivation, Caste, Accidents, Vehicles

Introduction

Road traffic accidents have emerged as a major public health challenge worldwide. Rapid urbanization and increased motorization are contributing to significant social and economic challenges in both developed and developing nations. Globally, road traffic accidents are the eighth leading cause of death, resulting in approximately 1.35 million fatalities each year¹. In India, over 150,000 people lose their lives annually due to road crashes, with Tamil Nadu reporting the highest fatalities at an alarming rate of 35 deaths per day. If current trends persist, projections indicate that by 2025, road traffic crashes could cause death or injury to 63% of the global population².

In Karnataka, road accident statistics have fluctuated from 2019 to 2022. The number of accidents decreased slightly in 2020, likely due to the COVID-19 pandemic, from 40.66 thousand in 2019 to 34.18 thousand. However, this number rose again in 2021 to 34.65 thousand and increased further to 39.76 thousand accidents in 2022. The increase in fatalities, from 344 in 2020 to 723 in 2024, highlights the growing severity of the issue (NCRB Reports, 2024). Since 2000, social scientists have increasingly focused on the demographic and socio-economic factors influencing road traffic accidents, recognizing these as significant correlates in understanding crash incidence. Studies consistently show that lower-income regions, especially middle- and low-income households, experience a disproportionate share of road crashes. Drivers from lower socio-economic backgrounds are involved in nearly twice as many accidents as those from higher-income groups. Factors such as limited education, financial insecurity, unskilled employment, and poverty-related mental health conditions contribute significantly to this elevated risk^{3,4}.

Demographic factors also play a critical role. Males, especially those in their second and third decades of life, are more frequently involved in crashes. In economically disadvantaged families, young individuals often begin working early, exposing them to greater crash risks. Research from countries like Iran and the United States supports this, showing that adults from low socio-economic communities are particularly vulnerable to road accidents. Furthermore, trauma care studies in France indicate that individuals from lower socio-economic backgrounds disproportionately rely on universal healthcare insurance for road injury treatment^{5,6}. In India, individuals from lower socio-economic backgrounds are particularly vulnerable to road accidents for several reasons. These groups often lack the financial means to afford proper road infrastructure, vehicle maintenance, or insurance. As a result, they tend to own older, less safe vehicles, further increasing the likelihood of accidents. After an accident, access to timely and quality medical care remains a challenge, as socio-economic disparities limit access to essential health services, worsening the severity of injuries⁷. Marginalized communities, such as those belonging to lower castes (Scheduled Castes, Scheduled Tribes, and Other Backward Classes), face compounded risks due to social exclusion, poverty, illiteracy, and stigma. These communities often experience higher rates of road accidents, driven by their disadvantaged socio-economic status, lack of access to road safety education, and insufficient healthcare resources. Furthermore, these groups are less likely to have the social capital needed to navigate the complexities of road safety and emergency healthcare systems⁸.

India's caste-based social structure exacerbates these risks. Scheduled Castes (SC), Scheduled Tribes (ST), and Other Backward Classes (OBC) are particularly vulnerable due to entrenched social exclusion and economic deprivation. These communities are often marginalized in terms of access to education, healthcare, and economic opportunities, which increases their exposure to road traffic accidents. Social exclusion, coupled with limited access to road safety education and basic health services, further intensifies their vulnerability to road crashes and injuries^{9,10}. Addressing the intersection of socio-economic disparities and road traffic accidents in India requires a comprehensive and multi-dimensional approach. Improving access to education, promoting occupational skills, enhancing mental health support, and fostering inclusive community programs are key strategies to mitigate the impact of socio-economic vulnerabilities on road safety. Special attention must be given to marginalized communities to reduce the impact

of social exclusion on their road safety outcomes. It is essential to develop targeted interventions aimed at improving road safety awareness and access to healthcare for disadvantaged populations, especially in rural and economically disadvantaged regions.^{11,12} This study aims to examine the socio-economic factors influencing road traffic accidents in Karnataka, focusing on caste, education, occupation, and poverty, with the goal of developing a more equitable road safety framework that can benefit all sections of society.

Methodology

The current study was conducted in five districts of Karnataka state, located in southern India. Data were collected from various police stations across five multi-caste populated districts: Mysuru, Bangalore, Ramanagara, Kodagu, and Chamarajanagara based on accident rates, population size, or socio-economic status. Accident cases registered between 2018 and 2022 were retrieved from 23 police stations in these districts, focusing on two-wheeler and four-wheeler accidents. A total of 4,998 cases were analyzed, categorized by victim characteristics such as gender, education, occupation, caste, and whether the outcome was fatal or non-fatal. In selected cases, we engaged with accident survivors and the relatives of fatal victims to gather additional information. First Information Report (FIR) copies from the police were retrieved (with permission) to investigate the specific causes of accidents and assess property damage. Ethical clearance was obtained from a local institution. Since reliable income data were not available in police records, socioeconomic variables like education, occupation, and caste were used as proxies for analysis. The dependent variable in the study (fatality) is qualitative and dichotomous. A binomial logistic regression model was employed to assess the influence of independent variables (gender, caste, education, and occupation) on the dependent variable (accident outcome).

In addition to quantitative data, qualitative insights were gathered through in-depth interviews and focus group discussions (FGDs) with accident survivors, police personnel, legal professionals, NGOs, and academics. These interactions involved 10–12 open-ended questions, aiming to understand broader perceptions of road accidents. The data were analyzed using SPSS version 18.0 (IBM) for quantitative variables with a 95 per cent confidence interval, and qualitative data were processed with the NUD*ISD database. Missing and erroneous values in the dataset were excluded to ensure accuracy.

The dependent variable for the regression model was defined as binary, with "injuries" coded as '0' and "deaths" coded as '1' (Table 3). Independent variables included: Gender has been classified as male and female, with females as the base category. The negative coefficient for males indicates that males have a lower likelihood of dying in accidents compared to females. Caste of the victims was categorized as SC, ST, OBC, and General, with General serving as the base category. Education has been classified as basic/just-educated and uneducated, with uneducated as the base category. Occupation has been Classified as skilled, unskilled, and students, with students as the base category. The regression model demonstrated good predictive performance, accurately predicting 73% of the outcomes. While the model successfully predicted all fatalities, some omissions in injury cases were noted, primarily due to incomplete police documentation. Separate estimations for injuries and fatalities could not be conducted due to data constraints. Additionally, categorical variables with more than two levels were not analyzed using dummy variables

Table 1
Socio-economic Background of the Traffic Victims

Gender					
		Death	Injured	Total	p Value*
Male	Count	1188	160	1348	0.00
	%	88.1%	12.0%	100.0%	
Female	Count	2998	652	3650	
	%	82.1%	18.0%	100.0%	
Total	Count	4186	812	4998	
	%	83.8%	16.2%	100.0%	
Education Level					
		Death	Injured	Total	0.21
Low level of schooling	Count	1104	244	1348	
	%	81.9	18.1	100.0%	
Un schooling	Count	3138	512	3650	
	%	86.0%	14.0	100.0%	
Total	Count	4242	756	4998	
	%	84.9	15.1	100.0%	
Occupation Level					
		Death	Injury	Total	0.01
Students	Count	89	312	401	
	%	6.6	42.7	100.0%	
Skilled	Count	576	1777	2353	
	%	42.7	48.7	100.0%	
Unskilled	Count	683	1561	2244	
	%	50.7	42.8	100%	
Total	Count	1348	3650	4998	
	%	26.9	73.0	100.0	
Caste of the Victims					
		Death	Injury	Total	0.00
Scheduled Caste	Count	224	648	872	
	%	16.6	17.8	100	
Scheduled Tribe	Count	185	506	691	
	%	13.7	13.9	100	
Other Backward Caste	Count	725	2050	2775	
	%	53.8	56.2	100	
Others	Count	214	446	660	
	%	15.9	12.2	100	
Total	Count	1348	3650	4998	
	%	26.9	73.0	100	

(Sources: Police Records, 2017-2020)

* All Significant

Findings

The logistic regression analysis reveals the following significant relationships between the predictors and the dependent variable (frequency of road accidents): In the case of gender Male respondents are 0.55 times as likely as females (base category) to be associated with road accidents ($\text{Exp}(B) = 0.55$, $p = .000$). Next, Age is positively associated with road accidents. Each unit increase in age raises the likelihood by 1.43 times ($\text{Exp}(B) = 1.43$, $p = .019$). Further, Scheduled Castes (SC): Individuals from SC communities have 1.58 times higher odds of being

Fig 1
Age of the Victims

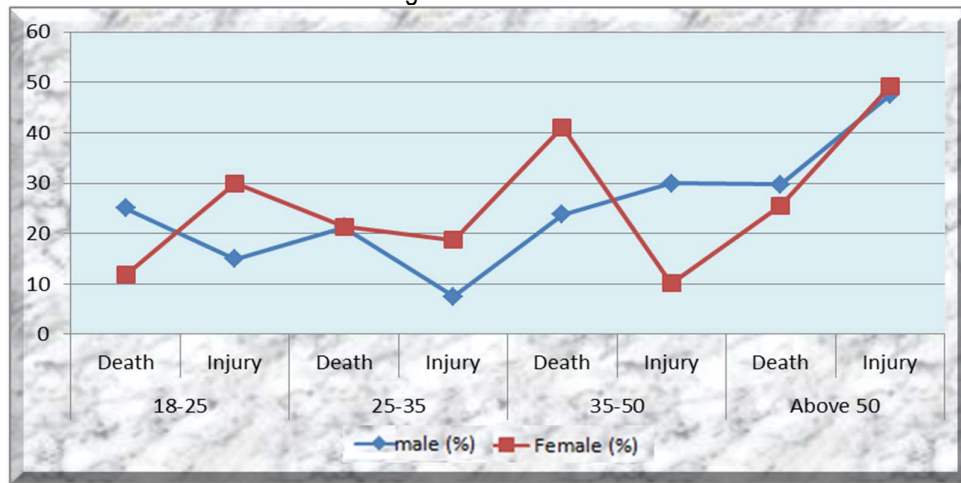


Table 2
Results of the Logistic Regression

Variables	Exponent of the Coefficient	P-Value	95% Confidence Interval for Exponent of the Coefficient	
			Lower	Upper
Gender (1) - Male	.55	.000	0.46	0.67
Age	1.43	.019	1.23	1.43
Caste				
SC (1)	1.58	.000	1.29	1.94
ST (2)	1.33	.016	1.06	1.69
OBC (3)	1.45	.000	1.21	1.73
Education	1.22	.021	1.02	1.46
Occupation				
Un Skilled/ (1)	1.54	.001	1.20	1.98
Skilled (2)	1.48	.000	1.30	1.69
Constant	2.19	.000		

Note: Gender: Male and Female with Female as base category; Caste: Scheduled caste (SC), Scheduled Tribe (ST), and Other Backward Caste (OBC) with General as base category; Occupation: Skilled and Unskilled with Students as base category. Gender (1) denotes Male, Caste (1) (2) (3) denotes SCs, STs, and OBCs, Occupation (1) (2) denotes unskilled/students and skilled

Table 3
Classification Table

Observed		Predicted		
		1= Dead, 0= Injured		Percentage Correct
		0	1	
1= Dead, 0= Injured	0	3650	0	100
	1	1348	0	0
Overall Percentage				73

involved in road accidents compared to the General category ($\text{Exp}(B) = 1.58$, $p = .000$). Scheduled Tribes (ST): Individuals from ST communities have 1.33 times higher odds ($\text{Exp}(B) = 1.33$, $p = .016$). Other Backward Classes (OBC): Individuals from OBCs have 1.45 times higher odds ($\text{Exp}(B) = 1.45$, $p = .000$). in the case of Education Individuals with low levels of education (primary or below) are 1.22 times more likely to be associated with road accidents compared to higher education levels ($\text{Exp}(B) = 1.22$, $p = .021$). However, in the case of Occupation

Respondents in unskilled roles have 1.54 times higher odds of road accident involvement compared to students (base category) ($\text{Exp}(B) = 1.54, p = .001$). Skilled workers have 1.48 times higher odds compared to students ($\text{Exp}(B) = 1.48, p = .000$). In summary, male respondents are significantly more likely to be associated with road accidents, with a high statistical significance ($p < .001$). Socio-economic factors like caste (SCs, STs, and OBCs), low education levels, and occupation (skilled and unskilled roles) are strong predictors of road accident frequency. The model provides evidence that both demographic and socio-economic variables are critical in understanding the likelihood of road accidents. This table (2) underlines the significant impact of socio-economic and demographic characteristics on road accident frequency, supporting arguments for targeted interventions.

Discussion

The objective of this study is to examine road accidents through the lens of key socio-economic determinants using a cross-sectional study design. The findings are robust, owing to the large sample size and the inclusion of diverse community-based samples from various strata of Indian society. In terms of geographical distribution, Bangalore, as a metropolitan city, recorded the highest number of accident-related deaths and injuries, followed by Mysore city during the study period. Regarding the victims' demographics, over 71% of male and 29% of female victims were from rural areas (Table 1). Gender-wise, the fatality rate was higher among men (88%) compared to women (82%). Male drivers were more prone to fatal accidents than female drivers, likely due to spending more time on the roads. Additionally, studies indicate that males from disadvantaged backgrounds often exhibit risky and careless road behavior and disregard for traffic rules. Notably, the gender gap in crash fatalities per accident has been narrowing in recent years, aligning with trends reported in the NCRB Report (2018).^{13,14} Also, cultural or behavioural factors that further contribute to these disparities cannot be ruled out.

This study, however, revealed a slightly higher proportion of non-fatal injuries among female victims (18%) compared to male victims (12%). While this gap is relatively small, it indicates that the gender disparity in non-fatal injuries is also narrowing over time¹⁵. This shift could be attributed to the increased economic independence and employment opportunities available to all genders in the era of globalization. Consequently, more women, especially those from lower socioeconomic backgrounds, are spending a significant amount of time on the road for work and other purposes^{16,17}. Understanding gender differences in road behavior is essential. Research suggests that males often demonstrate better driving skills, whereas females tend to be less aggressive and more likely to adhere to traffic rules. Additionally, as women age, they may experience heightened driving stereotype threats compared to men¹⁸. Despite these observations, experts emphasize the need for new data to better understand and address the gender gap in non-fatal road accidents.

Regarding age, both younger and older individuals (of both genders) are more likely to be involved in accidents compared to middle-aged individuals. Male riders, across all age groups, are slightly more likely to experience fatalities than female drivers. Interestingly, older women were involved in significantly more accidents than men, and the injury rate among elderly females (49%) was higher than that of their male counterparts. It has been observed that the number of fatalities and injuries increases with age (Fig 1). When combined with a poor socioeconomic

status, age becomes a particularly crucial factor. In such deprived conditions, a lower socioeconomic status can lead to a rapid decline in cognitive and mobility abilities, further increasing the risk of accidents. Age groups, however, exhibit variations in terms of the type of transportation used and the severity of the accidents.^{19,20}

Low levels of schooling are more prevalent among marginalized and underprivileged groups, which contribute significantly to road accident fatalities and injuries. This study reveals that 86 per cent of illiterate individuals have succumbed to accidents, with the injury rate also notably higher among those with limited education. The findings indicate a clear correlation between educational attainment and mortality rates in both urban and rural populations²¹. Other studies have highlighted an inverse relationship: as the level of education increases, the likelihood of accident-related fatalities and injuries decreases. Educated individuals are also less likely to be involved in accidents caused by reckless behaviour such as alcohol consumption or speeding.^{4,17} Interviews with accident survivors revealed that individuals with lower levels of education often possess limited knowledge and awareness about crucial safety measures, such as wearing helmets, using seatbelts, and understanding traffic signs. Furthermore, these individuals may have inadequate understanding of traffic rules and norms, which increases their vulnerability on the road^{22,23}. The heightened risk among those with lower educational levels can be attributed to a range of factors, including behavioural issues, lack of awareness about road safety, contextual challenges, and vehicle-related problems. These individuals are often less equipped to navigate the complexities of road safety, making education a key factor in reducing accident-related harm. The findings underscore the need for targeted educational initiatives aimed at improving road safety awareness among disadvantaged populations²⁰.

Some studies have established a clear link between poverty and road accidents. Low levels of education typically lead to unskilled employment, which in turn results in low wages and material deprivation.^{3,14,17} After adjusting for age and sex, it was found that the mortality rate from road crashes is significantly higher among unskilled workers (50.7%), most of whom are employed in the unorganized sector.^{24,25} Interestingly, students and unskilled workers experience similar injury rates, which warrant further exploration. This study also revealed that many of these students come from low-income, rural backgrounds. According to a World Bank study (2018), low-income households are twice as likely as high-income households to experience fatal traffic accidents, and crash-related disabilities are also more common among poor families. Poverty and limited income hinder the ability to invest in safe driving practices, crash-proof vehicles (such as those with airbags), and timely vehicle maintenance. This financial strain is a significant factor contributing to the rising mortality rate. Due to financial constraints, many low-income individuals rely on second-hand or poorly maintained vehicles, which tend to have lower crash ratings and outdated safety features²⁶. Interviews with accident survivors revealed that around 68.5% of injured victims reported that their vehicles were old and had faulty systems, further highlighting the risks associated with inadequate access to safe and well-maintained vehicles. This evidence reinforces the need to address economic disparities and invest in safer, more reliable transportation options for disadvantaged communities²⁶.

Recent studies have highlighted the sensitivity of specific groups to road crashes, with a growing focus on socio-economic and caste-related factors⁴. Consistent with previous research, our findings indicate that individuals from Scheduled Castes (SC), Scheduled Tribes (ST), and Other

Backward Classes (OBC) with low socio-economic profiles such as poverty, deprivation, low education, unskilled employment, and underpaid jobs are more likely to experience road accidents compared to individuals from forward castes^{15,17}. Poverty, low levels of education and low-paying jobs are particularly prevalent among these marginalized groups. The OBC category, in particular, exhibits the highest rates of both fatalities and injuries, largely due to the concentration of economically disadvantaged sub-castes within this group, followed by the SC group. Interestingly, the relationship between minority status and road accidents was not found to be significant in the adjusted model. Therefore, it can be concluded that caste itself does not significantly influence road crash outcomes, but rather the socio-economic factors associated with caste and class are more determinative in accident susceptibility⁶.

The focus group study revealed that individuals from deprived castes often experience a range of socio-psychological challenges, including historical isolation, rejection, and deprivation, which contribute to low self-esteem, insecurity, and a sense of not belonging. These factors, along with poor social networks, discrimination, and health issues, are prevalent among these groups and may significantly increase their risk of being involved in road accidents¹⁶. Certain personality traits, such as low self-esteem, aggression towards co-riders, reckless behaviour (like illegal driving, showboating, wheelies, and triple riding), frequent signal violations, and the presence of depressive disorders, are more common among youth from disadvantaged backgrounds. These behaviours likely contribute to the higher incidence of traffic accidents in this demographic. Furthermore, there is a close relationship between income, mental health, and social capital, with each factor impacting rider behaviour on the road. Limited income often restricts access to safer vehicles and driving education, while mental health issues and weak social networks may exacerbate risky behaviours, creating a compounded effect on road safety⁵. These findings suggest that addressing the underlying socio-economic and psychological factors is crucial in reducing accident rates among marginalized groups.

The majority of respondents believed that individuals from low economic backgrounds, who often spend significant time on the road, face a higher risk of road accidents. Our interviews further revealed that many of these individuals come from economically disadvantaged regions, where access to quality trauma care is limited. In numerous cases, poor accident victims do not receive legal compensation due to a lack of education, awareness, and financial resources. Many are unable to afford the fees of lawyers to pursue legal action. As a result, victims suffer additional losses, including lost income and employment due to disability and hospitalization¹⁵. Moreover, it was found that over 92% of victims lacked basic insurance, and more than 71% were from underserved areas. People from low socioeconomic groups were more likely to rely on government health insurance for managing the aftermath of crashes. These findings highlight the compounded challenges faced by disadvantaged individuals in the aftermath of road accidents, underscoring the need for better access to legal, financial, and healthcare resources for these communities.

Future research on road crashes could explore the following areas: 1) the involvement of social roles and conditions in causing both minor and major accidents, 2) the consideration of accidents as a socially inappropriate form of deviance, and 3) how poverty contributes to reduced road safety among marginalized groups. Some limitations of the study include: 1) its cross-sectional nature, which prevents generalization about causality and injury relationships, 2) insufficient data

from police records, 3) limited focus on individuals from forward castes, 4) a lack of comprehensive qualitative data to explain the precise role of low socio-economic factors in road crashes, 5) the exclusion of environmental and driver characteristics from the analysis, and 6) the absence of specific data on property damage or losses from police records.

Conclusion and Recommendation

This study highlights the significant impact of socio-economic factors such as education, occupation, and income on road accident rates. Lower socio-economic status is directly linked to higher rates of road trauma and injuries, with uneducated and unskilled individuals at greater risk. It is recommended that the government focus on improving the socio-economic conditions of high-risk groups and introduce affordable insurance schemes for them. Additionally, a more stringent monitoring system for issuing driving licenses to individuals with limited education is crucial, along with integrating road safety education at the school level. The study also emphasizes the need for more research to explore the specific socio-economic mechanisms contributing to road accidents, especially among marginalized communities. Targeted, region-specific road safety interventions, engaging local populations, and longitudinal studies are essential to reduce disparities in road safety and trauma. Additionally, fostering the social construction of responsible road behavior should be a key part of these efforts. To address the unique needs of different communities, a regionally and culturally specific crash reduction model that engages local populations is urgently needed. Longitudinal studies or intervention-based studies also recommended in this issue. In conclusion, addressing socio-economic disparities, improving education, and fostering safe road behavior are vital steps in reducing road accidents and their impact on public health.

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Major Health Issues and Health Seeking Behaviour of Vulnerable Lodha Tribe in Eastern India: A Narrative Review

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Abstract

Tribes are indigenous native people who considered as the first origin of the earth. In India, tribal population is high and according to census 2011, the percentage share of scheduled tribe population is 8.6 per cent. 80 per cent of total tribal population resides in Madhya Pradesh, Odisha, Chhattisgarh, Jharkhand, Maharashtra, Rajasthan, Gujarat, West Bengal, Andhra Pradesh etc. Madhya Pradesh is the first ranking state in total number of tribal population and followed by Maharashtra, Odisha. Lodha community has a long colonial history where they were declared as a “criminal tribe” by Britishers. Lodha community bears poor health status and in-depth information of their health and demographic components are missing from recent research trend. The main focus of this paper is to explore major health issues and health seeking behaviour of this primitive tribe. Present study uses many databases for literature download like PubMed, EBSCO, Google Scholar. All possible combination of keywords has been made and with the help of inclusion-exclusion criteria data are collected. Total 12 literature selected for final review. Sexual and reproductive health (SRH) of Lodha women is less explored domain in their entire health aspect. Nutritional status highly investigated topic in past study which is found in previous literature. Literature reveals that the Lodha tribe suffers from high malnutrition, poor menstrual hygiene management, reproductive tract infection, wrong health perceptions exist, negligence observed for early initiation of breastfeeding practice. ASHA workers are giving hope for improving health status of this PVTGs by creating positive impact on health perceptions but need community specific attentions to educate them. Government of India have taken initiatives to protect this tribal community in many ways. Recently, 2023-24 budget announced Pradhan Mantri Particular Vulnerable Tribal Group Mission to improve socio-economic condition of particular vulnerable tribal groups.

Key words: Health issues, Lodha, Nutrition, PVTGs, Sexual Reproductive Health, Odisha, West Bengal, etc.

Introduction

Tribes are indigenous native people who considered as the first origin of the earth and also known as the first inhabitant of the mother land. They are socially, educationally, economically backward people who face social discrimination^{1,2}. They mainly rely on forest resources and strongly tied with nature. In India, tribal population is high and according to census 2011, the percentage share of scheduled tribe population is 8.6 per cent. 80 per cent of total tribal population resides

in Madhya Pradesh, Odisha, Chhattisgarh, Jharkhand, Maharashtra, Rajasthan, Gujarat, West Bengal, Andhra Pradesh, etc. Madhya Pradesh is the first ranking state in total number of tribal population and followed by Maharashtra, Odisha. In case of proportion, Lakshadweep is first. Mizoram and Nagaland are also considered tribal dominated states due to high proportion share of tribal people. In Odisha, maximum number of tribal communities are found. Thus, the Ministry of Tribal Affairs identified 705 tribal communities in all over India and among them 75 come under Particular Vulnerable Tribal Group (PVTGs)¹.

Gond, Bhil and Santal are the largest tribal communities in this country³. In India communities matter more with comparison to individual. Lodha community has a long colonial history where they were declared as “criminal tribe” by Britishers. Many communities of India treated as the brave, freedom fighter even after killing many people but this hunter and gatherers, marginalised, poor people designated with the title “criminal tribe” of India due to their unusual social behaviour. Suspicious eye always stayed on them. Lodha tribe had been assigned with various designation in past. First initiative was started by British government by considering them “Criminal Tribe”. After this, they considered it as a “denotified tribe” in post-colonial history, again shifted their title and had been treated as “Primitive Tribal Group”. Now, finally they known as “Particular Vulnerable Tribal Group (PVTGs) of India” and as name suggested their total population is decreasing which should be the concern for entire nation^{4,5}.

Lodha is one of the PVTGs of India. Apart from this, other tribes also come under in this group. In general, this grouping is done state wise and this community mainly resides in Odisha and West Bengal. In both the state, they treated as PVTGs due to propensity of extinction in near future. Government of India have taken initiatives to protect this tribal community in many ways. Recently, 2023-24 budget announced Pradhan Mantri Particular Vulnerable Tribal Group Mission to improve socio-economic condition of particular vulnerable tribal groups³. Total 75 particular vulnerable tribal group were identified whose population started reducing and extinction chance remains in upcoming future. Therefore, many government initiatives have taken place to provide basic necessary supports and secure their population from extinction. PM JANMAN (*Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan*) is one of them. Socio-economic condition of Lodha tribe is pathetic to see and development takes in snail pace. Apart of this Integrated Tribal Development Project launched, Tribal Development Research Institutes (TRI) established, *Eklavya* Model Residential Schools (EMRSs) created and many scholarships introduced to develop overall social status of tribes. But the main problem is the lack of awareness and illiteracy which restricts them to avail their rights. One study was done on the impact assessment of *Rastriya Sama Vikas Yojana (RSVY)* and Indira Awas Yojana scheme in West Bengal. Here, it was found that the government was unable to properly distribute land among Lodhas, plan brick house and their maintenance. Lodha households also received solar cells which they sold wealthier families for money⁶.

In Odisha, the highest number of PVTGs are found. ICMR (2003) has studied the general health status of PVTGs of Odisha which shows unsatisfied and concerns to their health. Infant mortality, under-five mortality, anaemia, underweight, acute respiratory tract infection, diarrhoea, malnutrition, sexually transmitted disease, etc. are very high in PVTGs of Odisha⁷.

Healthy population is the main factor for development of any community and complete physical, mental and social wellbeing denotes better health status. Lodha community bears poor health status and in-depth information of their health and demographic components are missing from recent research trend. Scanty evidences are found wherein tried to capture this tribe's health and demography. One study was done by Kapoor and Kshatriya where authors explored fertility and mortality differences among north western and eastern tribes of India. Total 409 Mina, Bhil, Sahariya, Munda, Santal and Lodha mothers were selected as target respondents. All these women have completed reproductive life span. In result found that average numbers of live birth of Lodha tribe was 4.19 which was highest among the all-tribal community and proportion of survivor was least in this tribe. Pre-reproductive and embryonic mortality was high in Lodha⁸. A study was conducted by Saha, et.al., on child health, immunisation and breast feeding of Lodha tribe in West Bengal. The study highlighted homogeneous socio-economic condition of the tribe and less variation in education level, standards of living. But age, occupation, education level and religiosity had influence on various superstitious believes of child health which was significant by Cramer's value. It implies that younger mother, better occupation (engaged with agricultural activities), high education level and less religiosity value had better impact on child health practice. In the same study authors investigated mothers' awareness regarding child immunisation, 74 per cent Lodha mothers agreed to the necessity of child immunisation for saving their child from morbidity and mortality but only 35 per cent mother had given full immunisation to their younger child. Breastfeeding was universally practiced by Lodha mothers but here discovered lack of awareness for early initiation of breastfeeding. Therefore, need breastfeeding education to the mothers. Wrong child health perception was the barrier to achieve healthy and growing child in the community and that child will be the asset for the development of any community. Here require community specific programs to create awareness and to provide health education⁹.

Objectives

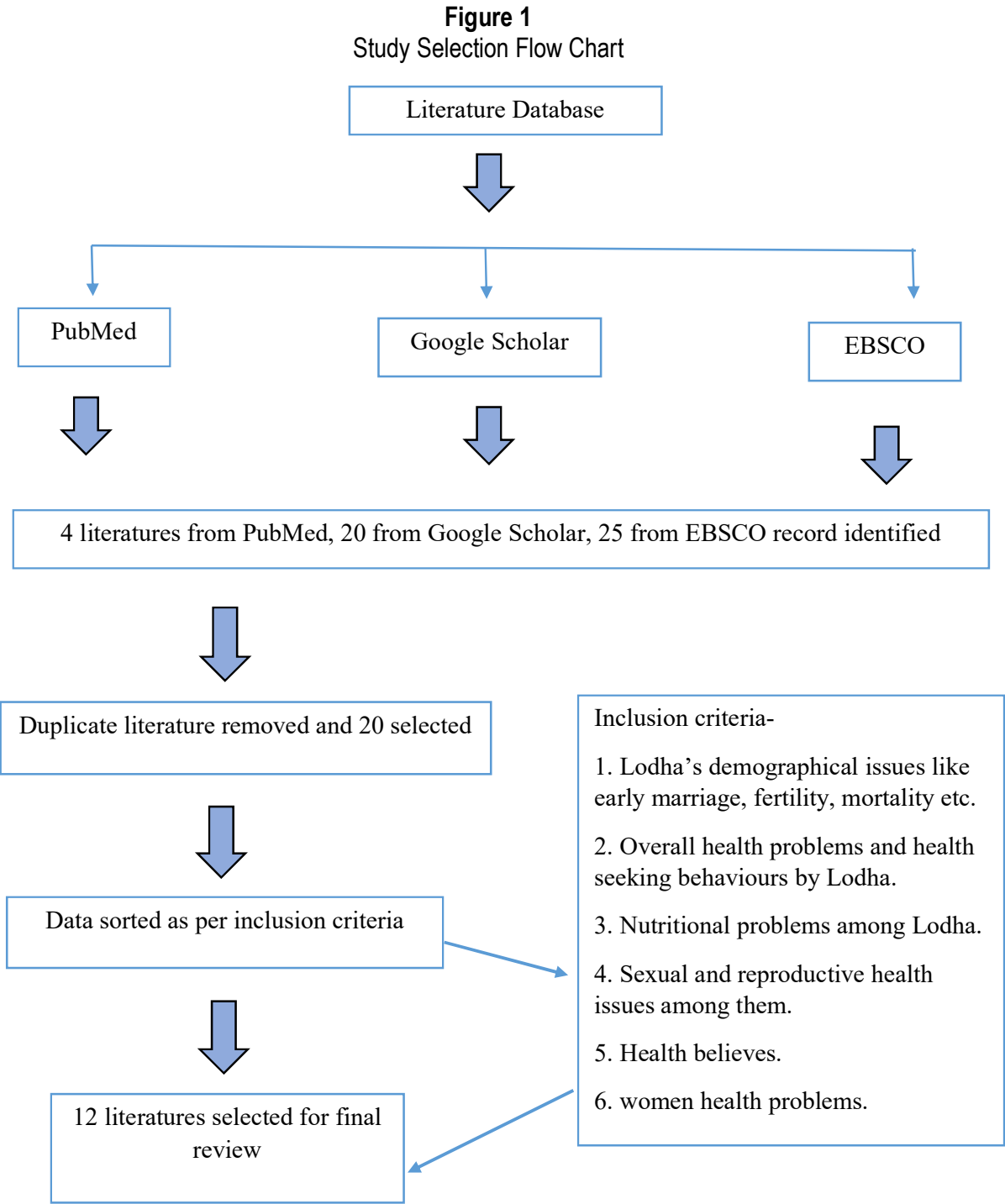
The objectives of this study was to

- accumulate all the published information regarding the tribe in a single place. Therefore, incorporated available information of Lodha tribe from Census of India with literature based narrative review; and
- explore major health issues and health seeking behaviour of the Lodha people. This study also tried to find out least explored major health domains of this PVTGs.

Methodology

Retrieval: Present study used many databases for literature search like PubMed, EBSCO, Google Scholar etc. In research strategy, we won't limit the publication year due to less availability of the literature. All possible combination of keywords has been made such as (Lodha OR "Lodha Tribe") AND (Health OR "Health Issues" OR "Health Problems" OR Disease OR "Sexual Reproductive Health" OR "Health Care Seeking Behaviour"). Manually also tried to check the reference list for additional publication. Keywords kept in title and abstract only due to maintain objectivity. Details of the selected paper is given in table 3.

Screening and Eligibility: However, very few literatures are found regarding health status of Lodha tribe which indicates less exploration of this particular vulnerable tribal group in health perspective. We screened the title and abstract with the help of pre-defined inclusion and exclusion criteria. Duplicate results also removed here.

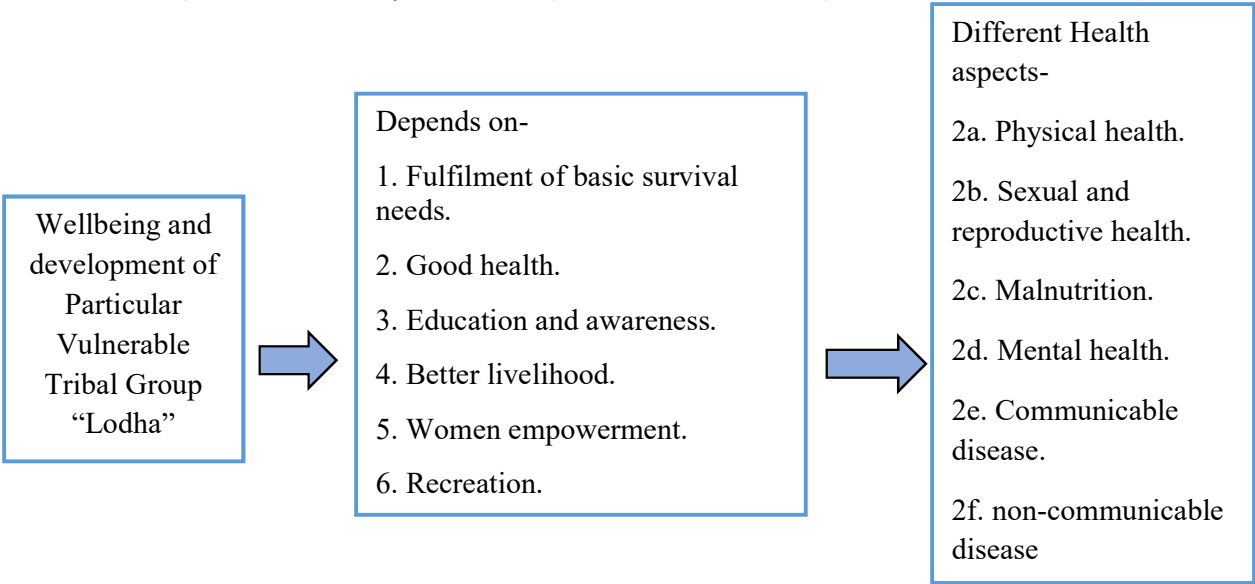


Data Extraction and Analysis: After final selection of the literature, we rigorously studied full texts of each item and discovered highly studied health aspects of this tribe which is "Nutrition

and health problems”. In most of the study this sub domain in entire health aspect is highly investigated and sexual reproductive health is got less attention of the researcher thus only three article able to collect regarding SRH. Presence of communicable and non-communicable disease in Lodha tribe also found in few literatures.

Conceptualization of the Study: A conceptual framework is given in figure 2 which depicts how overall wellbeing is affected by health issues. Socio-economic condition of Lodha is very pathetic and apart of this found high malnutrition, poor hygiene condition, more illiteracy. Early marriage is another problem and this gate way gives early exposure and long span to sexual activity. Meanwhile very early entry in marriage, increases long reproductive span and low level of education makes more sensitive to Lodha women’s health. Health seeking behaviour becomes important here. Anyhow, sexual reproductive health awareness is negligible and traditional healing practice exist among them which is found in literature. Here arises importance to explore and study major health problems, neglected health aspects which may be the reasons of decreasing population size of this particular vulnerable tribal group.

Figure 2
 Conceptualization of Study: How Development of Lodha Tribe Depends on Different Health Aspects



Findings

Table 1 reveals scheduled tribe population share and total Lodha population in India. According to 2011 census data, 8.6 per cent population of India is ST and it slightly increased from 2001 to 2011. Lodha tribe is considered as Particular Vulnerable Tribe in Odisha and West Bengal but apart from these states, they also found in Jharkhand as per literature. Most of the Lodha hamlets are found in Western and Southern part of West Bengal like Jhargram, Paschim Medinipur, Bankura, Purulia districts. Mayurbhanj district of Odisha is another hotspot of Lodha concentration. Basically, forest and remote areas are the residential area where they keep themselves separate from rest of the world. Total population size in West Bengal is 108707 and in Odisha it is 9785.

Table 1
Total Population of ST and Lodha

Census year	Total Population in millions	Scheduled Tribe (ST) Population in millions	Proportion of ST Population	Total Lodha Population	
				Odisha	West Bengal
1951	361.1	19.1	5.2	-	-
1961	439.2	30.1	6.8	-	-
1971	547.9	38.0	6.9	-	-
1981	665.3	51.6	7.8	-	-
1991	838.6	67.8	8.1	-	-
2001	1028.6	84.3	8.2	8905	84966
2011	1210.8	104.3	8.6	9785	108707

Sources: Census of India

Table 2 depicts demographic and socio-economic characteristics of Lodha tribe in West Bengal and Odisha. Male and female population in both the state stays in balance position, literacy rate is more among male Lodha and this gap is very high in between two sexes. Most of the male falls under main working category wherein most of the female comes under marginal working group. Census of India provides very limited information regarding any specific tribal group which is the limitation of this present study also.

Table 2
Demographical and Socio-economic Characteristics of Lodha as per Census 2011

Demographical and Socio-economic characteristics	West Bengal		Odisha	
	N	%	N	%
Total Population	1,08,707		9,785	
Total Male Population	54,692	50.31	4,860	49.67
Total Female Population	54,015	49.69	4,925	50.33
Total Literate	42,007	38.64	3,459	35.35
Total Male Literate	25,376	60.41	2,033	58.77
Total Female Literate	16,631	39.59	1,426	41.23
Total Illiterate	66,700	61.36	6,326	64.65
Total Male Illiterate	29,316	43.95	2,827	44.69
Total Female Illiterate	37,384	56.05	3,499	55.31
Total Main workers	29,438	27.08	2,815	28.77
Total Male Main Workers	19,196	65.21	1,819	64.62
Total Female Main Workers	10,242	34.79	996	35.38
Total Marginal workers	23,844	21.93	2,103	21.49
Total Male Marginal Workers	11,074	46.44	933	44.37
Total Female Marginal Workers	12,770	53.56	1,170	55.63

Sources: Primary Census Abstract, Census of India 2011

Sexual and reproductive health (SRH) of Lodha women is less explored domain in their entire health aspect. Nutritional status highly investigated in past study which is found in previous literature. Present study able to gather three paper which is related to Lodha's SRH. Saha et.al., has shown the evidence of Reproductive Tract Infection (RTI) among this primitive tribe. Authors tried to find out prevalence of RTI, symptoms respondent had, their perception and attitude towards RTI. The

study was done on undivided Medinipur of West Bengal. In this study found that 68.6 per cent respondent of total sample women had one or more than one RTI symptoms during the survey. Evidence for more symptoms found among the women who have longer marital duration, illiterate and engaged with forest product collection subsistence work. So, these factors were influencing the outcome variable RTI. In case of RTI symptoms, lower abdominal pain which is not related to menstruation and itching around the vagina were highly experienced by respondent (73.5%, 72.6% respectively). Abnormal quality of discharge and fishy smelling was also found high among Lodha females in Medinipur. Logistic regression of this study elaborated causes of RTI and here found that poor hygiene and low level of education was the prime determining factors of reproductive tract infection. In the same study focus group discussion was done to understand perception and attitude for RTI. Lodha female said their probable believes for having this infection, such as RTI was the consequences of evil, promiscuity etc. They also mentioned heat was the cause of white discharge due to alcohol consumption, spicy food intake by them and their husband. Respondents could not able to differentiate in between normal and abnormal vaginal discharge and also thought IUD insertion, surgery could be the cause for developing RTI. As a consequences sex relation and fertility pattern got effect. Respondents felt dirty, discomfort during intercourse, pain etc which directly affected their sexual interpersonal life. Treatment seeking behaviour was also explored by the authors and found that most of the women would like to take help of traditional healers, quacks and home remedies. Their few strange believes were also identified like vaginal ulcers automatically would be cured and no need to take help of doctors. If all traditional method failed to cure than only, they visit hospital or PHC. This attitude was the reason of unsupportive husband and family of the Lodha women, illiteracy, pathetic economic condition, age-old cultural practice. As a result, they are hiding the disease, practiced self-treatment, taken help from traditional healers which bring their health in danger and life in risk⁹. Another study was carried out by Gosh and Pal on West Bengal Lodha women regarding menstrual health and hygiene. Here found that respondents average age of menarche was 12 to 14 years and 66 per cent sample did not have prior knowledge of menstruation. They perceived that impure, dirty blood drained out from the body (28% sample) and it was curse of God. Very few respondents (4%) have taken it normal process. Authors also revealed half of the Lodha sample did not know the reason of bleeding, 60 per cent did not feel necessity to clean genitalia during periods and 66% had no idea about relation of genital infection with unhygienic menstrual practice. Most of the women used to reusable cloth or rugs (88%) to protect blood stain and 2 per cent used sanitary napkins. 90 per cent respondent did not have specific place to change due to absence of toilet in house, 52 per cent respondents changed sanitary products once in two days and followed by daily once (36%). 72 per cent sample irregularly washed genitalia during periods. Age and education were the two important factors in maintaining hygienic menstrual practice. Younger Lodha participants well managed their menstrual hygiene with comparison to older Lodha women⁹. Dasgupta et.al., conducted a study which is related to menopausal symptoms and its correlates. This study was a comparison study among the Lodha tribe and Caste participants. Tribal women got early menopause with comparison to Caste women and menopause symptoms like vaginal dryness, bad smell, vaginal discharge was found more among Lodha. Vasomotor symptoms like hot flush were linked with early age at menarche and early age of last pregnancy which was high among tribal group, night sweat was also associated with history of reproductive wastage and it increased in tribal respondent. Painful urination was also found among Lodha women which is the result of heavy menstrual discharge¹⁰.

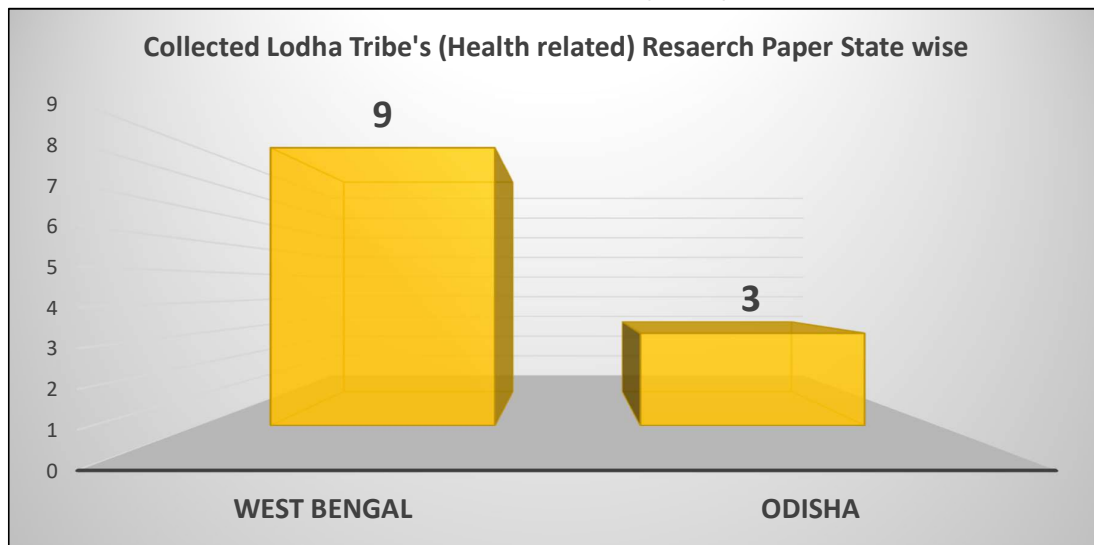
Malnourishment is a major problem for healthy and growing India. This problem is severe in underprivileged backward people like Lodha tribe. Many studies were conducted previously to assess its intensity among this primitive tribal group. Bisai et.al., highlighted the prevalence of underweight, stunting, wasting of West Bengal based Lodha children in their study. They found 33.9 per cent, 26.1 per cent, 19.4 per cent children underweighted, stunted and wasted respectively. Lodha children also had severe form of malnutrition (9.1% underweight, 9.7% stunted and 3.6% wasted), it was high among boys and preschool children with comparison to girls and school going children. Preschool children were the most vulnerable group who had severe to more severe form of malnutrition¹¹. Another study was done on “Nutritional and Health Status of Adult Women of the Lodha Tribal Population of Paschim Medinipur, West Bengal, India: Compared with Nontribal Women” by Bepari, Pal et.al. In this study various nutritional indicators were used to investigate physical as well as nutrition of this degenerated tribal women. Height, weight was measured and with the help of this two BMI calculated. Most of the tribal women lies in underweight category and undernutrition was eleven times higher than women of general caste. Only 20 per cent sample women of Lodha community came under normal BMI category other hand 59 per cent general caste women had normal BMI. In the same study blood pressure and haemoglobin was also measured. Most of the study subjects from Lodha tribe had normotensive BP but 32 per cent experienced hypotensive. In anaemia, 92 per cent Lodha participants were anaemic and severe form of anaemia was significantly high among Lodha with comparison to general category. A study was conducted in Mayurbhanj district of Odisha which is one of the hotspots of Lodha tribal population^{12,13}. Bhuyan and Behera highlighted Lodha male was in a better nutritional condition with comparison to female counterpart in their study. Females suffered more Chronic Energy Deficiency (CED) and obesity was more among male. A study was conducted by Dash et.al., in Odisha wherein authors have shown healthcare management and nutritional status of Lodha tribe. BMI and calorific value of the food consumption of the family were measured and recorded to assess nutritional status of this tribe. Study highlighted severe malnourishment was more among male (16%) with comparison to female (13.2% severe malnourished). Adult caloric value revealed 18.5 per cent household had severe malnourishment, 16.3 per cent moderate malnourished, 45.8 per cent mild malnourished. Only 17.2 per cent household came under normal and 2.2 per cent had overweight. This study was also tried to identify health managements by the community. There found that 52 per cent respondents seek help from ASHA, 31.7 per cent avail health services from traditional healers, 11.9 per cent from ANM and remaining 4.4 per cent from PHCs. So, role of ASHA workers was very important because most of the people met with ASHA which indicates good result but still traditional healers were also famous in this tribe¹⁴.

Kar, Sabat et.al., revealed in their study prevalence of hepatitis c virus in primitive tribes of eastern India. The study covered 1765 participants from 5 primitive tribal groups of eastern India. Serum sample from six districts of Odisha had been collected. Anti-HCV antibody was detected 0 per cent, 3.3 per cent, 5.7 per cent, 8.5 per cent, 13.4 per cent in Saora, Lodha, Khadia, Juanga and Mankidia tribe respectively¹⁵. Thus, Mankidia and Juanga tribe had high prevalence of HCV infection. Another study was conducted by Kar and Roy which was entitled as “Factors associated with the CVD risk factors and body fat pattern of postmenopausal Hindu caste and Lodha tribal

populations living in India: An exploratory study”. In this study authors explored variation in body fat pattern and cardiovascular risk factors among Lodha tribe and Hindu caste women who reached natural menopause in West Bengal. This study found that Lodha women suffer more hypertension with comparison to Hindu caste people. Total cholesterol level was also high among Lodha participants but blood glucose level was low which indicated lower prevalence for obesity among this group¹⁶.

In figure 3, prepared a word cloud to identify research gap and less explored health aspects of this tribe. Frequency of the words in title is considered here. Nutrition health aspect highly investigated and SRH, communicable, non-communicable less studied. Here also found absence of mental health aspects, ageing health issues etc. Figure 4 shows less presence of literature regarding health condition of Lodha who belongs to Odisha with comparison to West Bengal.

Figure 4
State-wise Available Literature regarding Lodha Health



Conclusion

Better health status is an important asset for development of human civilization. Health condition and socio-economic status both are miserable of Lodha tribe. It can be the reason of their chance of extinction in future. Anywise, tribal health concern did not get high pace and momentum in contemporary health research. Tribes are deprived category of the society; they need and deserve special attention which is lacking in contemporary research. In-depth and authentic literature is rare to find regarding health status of this tribe. Few literatures discovered during this narrative review and all these data shows bad health condition among women and child of Lodha tribe. Mainly nutrition status assessed in past many studies wherein found high malnutrition in male and female both. High evidence found for early marriage practice in this community. Hence, sexual and reproductive health becomes the concern but this domain is less explored in literature. Place wise, Odisha Lodha attracted less attention of researcher and less evidence able to gathered in this narrative review of this particular place. Here noticed scanty and absence of literature regarding mental health, sexual and reproductive health, communicable disease, non-

communicable disease, child health, ageing issues, etc. We discovered immense need of comprehensive work on physical, mental, sexual and social health of this tribe in West Bengal and Odisha which will help to understand the level of vulnerability and to protect from extinction.

Limitations

Main limitation was realized during reviewing the papers are lack of authentic data and missing detailed information of particular health aspect of this tribe in literature. We did not consider any time limitation to gather the articles due to less availability of the study.

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Predictors of Workplace Violence in Indian Hospitals: A Cross-Sectional Survey of Nurses

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Abstract

Workplace violence is a common phenomenon among health care workers. Nursing staff with shift duties tend to spend longer duration in hospital premises and hence are at higher risk. The objective of this study was to assess the extent, perpetrators, mitigation strategies, reporting of WPV and predictors of workplace violence among nurses. Methods: A multicentre hospital based cross sectional survey among 511 nurses using a standard questionnaire was done. Descriptive and Logistic regression was used for analysis. Results: Among 511 participants 169 (33.1%) had experienced it wherein almost all (97.5%) experienced verbal violence, 75 (44.4 %) physical violence and 55 (32.5%) sexual violence. Perpetrators of violence in (26%) were patient's relatives. Majority 153 (90.5%) expressed regular training of healthcare workers as mitigation strategy. A significant association using chi square was obtained between demographic variables as Age ($\chi^2= 13.181$, $p=0.04$), Gender ($\chi^2= 8.675$, $p=0.013$), Nature of duty ($\chi^2= 18.257$, $p=0.000$), availability of Security Person ($\chi^2= 6.772$, $p=0.034$) and types of WPV. The overall binomial logistic regression model for predictors of workplace violence was significant with $\chi^2(5) = 29.53$, $p < 0.001$, implying that age, type of hospital, nature of duty, working area are significantly associated. The WPV in various forms with verbal abuse being the commonest is prevalent among nurses in India. The healthcare administration needs to be sensitized so that firm policies and procedures can be planned and executed to ensure delivery of quality Nursing Care.

Key words: Workplace violence, Nurses, Predictors, Risk factors, Hospitals, Verbal abuse, Physical abuse, Sexual abuse.

Introduction

Workplace violence (WPV) among healthcare workers is well-recognized as a serious issue worldwide. Nurses, being the largest group of frontline healthcare workers and spending long working hours in hospitals, are particularly at high risk¹. It has been reported that WPV in medical settings is four times higher than in other private sectors². This occurs because healthcare workers are often tasked with communicating unpleasant news to patients and caregivers, such as deteriorating conditions or death, as well as explaining complex treatments or procedures. Consequently, patients or their relatives may sometimes respond with violence, expressed through verbal, physical, sexual, or psychological assaults against healthcare workers³.

The prevalence of WPV in both developed and developing countries is alarming. A seven-country case study on WPV in the health sector found that more than 50 per cent of workers experienced at least one incident of either physical or non-physical violence in the preceding year. Reported incidences included 37 per cent in Portugal, 46 per cent in Brazil, 54 per cent in Thailand, 61 per cent in South Africa, 67 per cent in Australia, and 75 per cent in Bulgaria⁴.

A recent systematic review documented that 61 per cent of healthcare workers globally experienced some form of WPV in the last year, with 42 per cent encountering non-physical violence, such as verbal abuse (57%), threats (32%), and sexual advances (12%). Meanwhile, 24 per cent reported physical violence. In Asia, 64 per cent of healthcare workers reported WPV, with 45 per cent experiencing non-physical violence and 24 per cent facing physical violence. WPV rates in Asian countries are notably high, with 51 per cent in Pakistan⁵, 62 per cent in China⁶, and 63 per cent in India⁷. These studies consistently show that nurses are more susceptible to WPV^{4,5,8}.

Literature puts forth that various factors linked to WPV include personal factors such as occupation, gender, age, and marital status, as well as organizational factors like work schedule, department, and position within the healthcare hierarchy^{5, 7-11}. In a developing country like India, where the healthcare sector serves a large and diverse population from varied cultural and socio-economic backgrounds, the risk of such incidents increases manifold. Reporting these incidents is crucial in addressing this menace, but fear of victimization often discourages nurses from openly addressing them.

Objective

The *objective* of the study was to

- assess the extent of WPV, identify the common perpetrators, explore mitigation strategies, examine reporting mechanisms, and determine predictors of WPV among nurses employed in hospitals across India. To achieve these objectives, two null hypotheses were tested:
- H01: There are no significant predictors related to WPV among nurses in India.
- H02: There is no significant association between demographic variables (such as age, gender, marital status, years of experience, and department of employment) and the forms of WPV experienced by nurses in India.

Methodology

This paper presents findings from a larger research project on WPV among nurses in India. An online cross-sectional survey was conducted among nurses employed in both private and government hospitals across the country. Prior permission was obtained from hospital administrators before sharing the survey link with nursing staff. The survey link was distributed through multiple channels, including hospital administrators, professional WhatsApp groups, hospital groups, informal networks, and referrals by participants who had already completed the survey.

The eligibility criteria required that participants be nurses who had worked for at least six months in their current hospital and voluntarily agreed to participate in the study. Regular follow-up reminders were sent to ensure a sufficient response rate. A standard tool, developed by Kumari and others¹² was employed to gather descriptive data based on the study's objectives. This tool helped in assessing the extent of WPV, identifying common perpetrators, evaluating mitigation strategies, examining reporting mechanisms, and determining potential predictors of WPV among the nurses. The data collection included questions regarding demographic variables such as age, gender, marital status, job type, hospital type (private or government), and work schedule.

Data were analyzed using logistic regression to identify significant predictors of WPV, while Chi-square tests and other statistical methods were used to explore associations between demographic variables and the different forms of violence (physical, verbal, psychological, or sexual). The results provide insights into the factors increasing the risk of WPV among nurses in India and the socio-demographic profiles most vulnerable to such incidents.

Findings

Demographic Characteristics of Participants: A total of 511 nurses participated in the survey. The majority of respondents were under 25 years of age (234, 45.8%), with the predominant gender being female (371, 72.6%). In terms of marital status, more than half of the participants were married (267, 52.3%). Employment characteristics revealed that a significant proportion of nurses were employed in private hospitals (425, 83.2%), with 289 (56.6%) of them holding temporary job positions. The work schedule for the majority involved rotational duties (385, 75.3%).

Regarding work settings, most nurses were stationed in general wards (235, 46%), where they likely dealt with a broad spectrum of patients and situations. In terms of hospital infrastructure, 418 (81.8%) reported that their hospitals were equipped with security cameras, and 435 (85.1%) noted the presence of security personnel. However, when asked about the preparedness of security personnel to manage WPV, only 339 (66.3%) of the respondents felt that these security staff were adequately prepared to handle such incidents (Table 1).

Table 1
Distribution of Participants as per Their Demographic Variables (n=511)

Demographic Variables		f	%
Age	< 25 Years	234	45.8
	26-35 Years	210	41.1
	36-45 Years	48	9.4
	>45 years	19	3.7
Gender	Male	140	27.4
	Female	371	72.6
Marital Status	Single	223	43.6
	Married	267	52.3
	Separated	10	2.0
	Divorced	6	1.2
	Widow/Widower	5	1.0

Type of Hospital	Government	56	11.0
	Private	425	83.2
	Any Other	30	5.9
Job Status	Permanent	222	43.4
	Temporary	289	56.6
Experience in years (Mean± SD)		2.5 years ± 5.10	
Nature of Duty	Rotational	385	75.3
	Fixed	126	24.7
Working Area	Critical Care	204	39.9
	OPD	72	14.1
	General Ward	235	46.0

Prevalence of Workplace Violence (WPV): Out of the 511 participants, 169 nurses (33.1%) reported having experienced some form of WPV, while the remaining 342 nurses (66.9%) had not encountered such incidents. Among those who experienced WPV, verbal violence was the most prevalent, with 164 nurses (97.5%) reporting it. Physical violence was also notably frequent, affecting 75 participants (44.4%), while 55 nurses (32.5%) reported experiencing sexual violence (Figure 1). These figures underline the high incidence of verbal aggression within healthcare settings, followed by significant levels of physical and sexual violence. The data highlights the multifaceted nature of WPV, with many nurses enduring multiple forms of violence simultaneously, further exacerbating their professional challenges and personal safety concerns.

Forms of Workplace Violence: The participants experienced various forms of verbal, physical, and sexual violence during their professional duties.

- **Verbal Violence:** The most common forms of verbal violence included exaggerated arguments (61, 39.1%), followed by abuse (47, 30.1%), threats (17, 10.9%), and offensive comments (15, 9.6%). Verbal violence was often the precursor to more severe forms of aggression.
- **Physical Violence:** Among those subjected to physical violence, the most frequent incidents involved thrashing (23, 30.7%), slapping (19, 25.3%), beating (14, 18.7%), vandalizing (16, 21.3%), and even attacks with weapons (3, 4%).
- **Sexual Violence:** In terms of sexual violence, participants reported experiencing verbal offensive remarks (28, 50.9%), inappropriate physical behavior (10, 18.2%), misuse of professional authority (3, 5.5%), stalking (7, 12.7%), and rumors about their private lives (7, 12.7%).

These findings reveal the diverse and alarming nature of WPV that nurses encounter, from verbal confrontations to severe physical and sexual aggression, all of which contribute to an unsafe and hostile work environment.

Perpetrators of Workplace Violence among Participants: As illustrated in Figure 2, the majority of WPV incidents were perpetrated by patients' relatives, accounting for 26 per cent of the reported cases. This was followed by co-workers, who were also significant contributors to the violence experienced by the participants. Other notable perpetrators included patients themselves and, in some instances, hospital staff from other departments. These findings highlight the complexity of

WPV, where aggression not only comes from external sources (patients and their families) but also from within the healthcare system.

Mitigation Strategies to Control Workplace Violence: The study participants identified several mitigation strategies that were deemed effective in controlling WPV. Key strategies included controlling visits by attendants (143 participants, 84.6%), educating both patients and their attendants (152, 89.9%), and providing regular training for healthcare workers (153, 90.5%). Other significant measures highlighted were self-defense training for staff (129, 76.3%), improving healthcare infrastructure, such as increasing the doctor-patient ratio and population-bed ratio (142, 84.0%), and enhancing hospital facilities, such as ensuring the availability of medicines and diagnostic tests (154, 91.1%).

Additionally, participants emphasized the importance of upgrading infrastructure with security measures like CCTVs, metal detectors, and alarm systems (153, 90.5%). Establishing an effective complaint redressal system (145, 85.8%) and enforcing stronger legislative actions (149, 88.2%) were also identified as vital steps. Other suggestions included ensuring unbiased media reporting (122, 72.2%) and sensitizing politicians and public figures to the issue (125, 74.0%).

Association between demographic variables and types of WPV: Association was computed between demographic variables and types of WPV (verbal, physical, sexual). There was significant association found between types of workplace and demographic variables (Table 2) such as Age ($\chi^2= 13.181, p=0.04$), Gender ($\chi^2= 8.675, p=0.013$), Nature of duty ($\chi^2= 18.257, p=0.000$), Availability of Security Person ($\chi^2= 6.772, p=0.034$).

Table 2
Association between Selected Demographic Variables and Types of WPV (n= 169)

Demographic Variables		Any one type of WPV (n= 79)	Any two types of WPV (n= 58)	All three types of WPV (n= 32)	χ^2
Age	< 25 Years	23	23	9	$\chi^2= 13.181$ $p=0.04^*$ Df= 6
	26-35 Years	30	24	19	
	36-45	21	5	3	
	Above 45 Years	5	6	1	
Gender	Male	24	9	14	$\chi^2= 8.675$ $p=0.013^*$ Df= 2
	Female	55	49	18	
Hospital type	Government	26	22	4	$\chi^2= 7.426$ $p=0.115$ Df= 4
	Private	50	32	26	
	Any Other	3	4	2	
Job Status	Permanent	41	33	13	$\chi^2= 2.196$ $P=0.333$ Df= 2
	Temporary	38	25	19	
Duty type	Rotational	61	24	20	$\chi^2= 18.257$ $p=0.000^{***}$ Df= 2
	Fixed	18	34	12	

Working Area	Critical Care	38	17	16	$\chi^2= 6.760$ $p=0.149$ $Df= 4$
	OPD	6	4	1	
	General Ward	35	37	15	
Security Cameras	Yes	60	42	23	$\chi^2= 0.307$ $p=0.858$ $Df= 2$
	No	19	16	9	
Security Person availability	Yes	67	43	20	$\chi^2= 6.772$ $p=0.034^*$ $Df= 2$
	No	12	15	12	

*0.05 level of significance, *** 0.001 level of significance

Any one= Verbal /physical / sexual violence

Any two= Verbal and Physical /Verbal and Sexual /Physical and Sexual

All three= Verbal, Physical and Sexual

Predictors of workplace violence: The logistic regression model was evaluated based on an alpha of 0.05. The overall model was found to be significant, $\chi^2(5) = 29.53$, $p < 0.001$, suggesting that age, type of hospital, nature of duty, working area had a significant effect on WPV. The nursing personnel aged 36-45 years had experienced 14.578 times more WPV to the nurses above 45 years. The nursing personnel working in government hospitals had experienced 105.49 times more WPV to other hospitals. The nurses on rotatory duties had experienced 71.2 % lesser WPV to those working in fixed duties. The nurses at OPD had experienced 89.5 % lesser WPV compared to nurses working in general ward. The hospitals with security person have reduced incidence of WPV to 71.3% to their counterparts (Table 3).

Table 3
Predictors of WPV Predictors among Participants (n=511)

Predictor Variables	B	S.E.	P Value	OR	Lower Bound	Upper Bound
Age (Reference above 45 Years)						
< 25 Years	.778	.832	.350	2.176	.426	11.118
26-35 Years	1.170	.803	.145	3.221	.668	15.531
36-45	2.680	.879	.002*	14.578	2.601	81.707
Gender (Reference Female)						
Male	.304	.263	.248	1.355	.810	2.267
Type of Hospital (Reference Any other Hospital)						
Government	4.654	.802	.000*	105.049	21.827	505.571
Private	-.013	.464	.977	.987	.397	2.450
Job Status (Reference Temporary)						
Permanent	-.005	.261	.984	.995	.596	1.660
Nature of duty (Reference Fixed)						
Rotational	-1.246	.268	.000*	.288	.170	.487
Working Area (Reference General Ward)						
Critical Care	-.081	.258	.754	.922	.556	1.529
OPD	-2.251	.559	.000*	.105	.035	.315
Security Camera Installed (Reference No)						
Yes	.561	.374	.133	1.753	.843	3.645
Availability of Security Person (Reference No)						
Yes	-1.247	.338	.000*	.287	.148	.557
Constant	-21.486	17316.835	.999	.000		

$\chi^2(5) = 29.53$, $p < 0.001$

Discussion

In this study we assessed the magnitude and predictors of WPV among nurses in India. In the current study, one third (33.1%) of the respondents had experienced WPV in last one year. However, our findings are lower than that reported from the studies conducted in the Amhara region, Ethiopia (58.2%)¹³ North east Ethiopia (56%)¹, and Eastern Ethiopia (64%)¹⁴, Tunisia (56.3%)¹⁵, Rwanda (58.5%)¹⁶, Gambia (62.1%)¹⁷, Bangladesh (64.2%)¹⁸, Nepal (64.5%)¹⁹, and Istanbul, Turkey (64.1%)²⁰, Oromia region, Ethiopia, 82.2 per cent²¹, and China (79.39%)²². On the other hand, our finding was higher than research studies conducted in Hawassa, Ethiopia (29.9%), Gamo Gofa, Ethiopia (43.1%)^{23,24}, northwest Ethiopia (26.7%)^{25,26}. The difference in the findings may be due to the differences in sample size, socioeconomic status, study duration and methodology.

As per the current study, from a total of 511 participants, 169 who experienced WPV, almost all 164 (97.5%) had experienced verbal violence, 75 (44.4%) physical violence and 55 (32.5%) sexual violence. The results are higher than another study conducted among nurses in public health institutions in Hawassa, where physical violence incidents were 18.22%, for verbal abuse (89.58%), and sexual harassment (13.02%)²³. The variations in the results could be due to change in research settings, types of setting and research methodology.

In the current study verbal abuse (97.5%) was found to be the most common type of violence experienced. The results are similar to the other studies conducted by Likassa and others²¹, Magnavita and others²⁷, and Byon and others²⁸ wherein the verbal abuse was the common type of abuse experienced by the nurses. The reason for this could be that it is the easiest form in which the perpetrators can assault the health care worker without even the legal action taken against them.

This study identified that patients' relatives (26%) were the common perpetrators of WPV followed by Senior Nurse (17.8%) and Coworker (17.2%). The findings are somewhat similar to other studies done by Fute and others and likassa and others^{23,21}. However, in the current study the colleagues and senior nursing staff was also identified as some of the other sources of WPV. This may be due to frequent interaction of patient's relatives with nurses in stressful situations and work-related interaction with nursing colleagues and senior staff wherein arguments may result in violence incidents.

In the current study a significant association between types of workplace and demographic variables as Gender ($\chi^2= 8.675$, $p=0.013$), which is consistent with another study undertaken in Jordan²⁹, Palestine³⁰, and Hawassa²³. However dissimilar to another study conducted by Banda and others³³ wherein no significant difference was observed in the proportions of verbal violence between men and women (51% vs 50.8%; $\chi^2: 0.02$; $p=0.900$). The reason could be the sample size and mind-set of society in developing countries where females are considered weak and helpless and thus are at higher risk of facing WPV.

In the current study a significant association between age and WPV Age ($\chi^2= 13.181$, $p=0.04$). As per the logistic regression model analysis the nursing personnel with age between 36-45 years had experienced 14.578 times more WPV compared to the nursing personnel with age above 45

years. These findings are consistent to the findings of NEXT study conducted by Estryn-Behar and others³¹. However, the findings are contrary to the results by Fute and others²³, Magnavita and others²⁷, Weldehawaryat and others¹, where they found nurses over the age of 41 were three times more likely to face WPV than nurses under the age of 30. The difference in the findings may be due to the sample size and geographical variations. The older or more experienced nurses are well aware how to deal with a difficult situation as compared to younger nurses. The maturity in their behaviour and the societal norms also cause the older nurses to encounter less incidents of WPV.

In the present study it was found that rotatory duties ($\chi^2= 18.257$, $p=0.000$) had a significant association to WPV. The findings are similar to the other studies where the HCWs who work solely in night shifts or shift work with night duties are at a higher risk of experiencing WPV, including physical and verbal violence, compared with those who work regular day shifts^{31,32}.

Strengths of the study: To ensure participation and representativeness of nurses from diverse backgrounds and culture the online survey technique was used. The fear of victimization and sensitivity of the research topic were the reasons given for physical non-participation.

Limitations: The current study undertook an online survey, which may be attributed to some flaws. No specific statistical technique for sampling could be used here for gathering online data as the link was shared through various methods. The nurses who do not have access to gadgets as smart phones or who could not access google survey forms or who did not know how to use it were left out, causing selection bias. Causality could not be established due to descriptive nature of study.

Conclusion

Workplace violence (WPV) is a significant and concerning issue among Indian nurses, with approximately one-third of participants reporting experiences of violence in various forms. This prevalence emphasizes the urgent need for greater awareness and intervention within the healthcare sector.

The analysis revealed several critical predictors of WPV, including variables such as age, type of hospital (private vs. government), nature of duty (temporary versus permanent positions), and specific working areas (e.g., emergency wards vs. general wards). Understanding these predictors is essential for developing targeted interventions that can help reduce the incidence of WPV. As the frontline providers of care in the healthcare system, nurses often face unique challenges that place them at a heightened risk of violence. They frequently interact with patients and their families during stressful and emotional times, which can escalate to confrontations. Therefore, it is imperative that healthcare institutions implement comprehensive training programs focused on conflict de-escalation, communication skills, and personal safety strategies. Additionally, establishing sound policies and procedures tailored to preventing WPV is crucial in creating a safer working environment. Moreover, encouraging a culture of reporting and support is vital. Nurses must feel empowered to report incidents without fear of retribution, and there should be mechanisms in place for addressing and responding to reported incidents effectively.

The findings of this study highlight the critical need for multi-faceted strategies that include training, policy reforms, and improved support systems to protect nurses. By prioritizing the safety and well-being of healthcare workers, we can not only enhance their work experience but also improve the overall quality of patient care. It is essential for policymakers, hospital administrators, and nursing organizations to collaborate in addressing this pressing issue and ensuring that nurses can perform their vital roles without the threat of violence.

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Key Health Indicators (India)

S. No.	Indicator	Rural	Urban	Total	Source
A.	Fertility Indicators				
1.	Crude Birth Rate (CBR)	21.1	16.1	19.5	SRS Report 2020
2.	General Fertility Rate (GFR)	73.7	53.7	67.0	SRS Report 2020
3.	Total Fertility Rate (TFR)	2.2	1.6	2.0	SRS Report 2020
		2.1	1.6	2.0	NFHS-5 (2019-21)
4.	Sex Ratio at Birth	907	910	907	SRS Report 2020
B.	Mortality Indicators				
1.	Crude Death Rate (CDR)	6.4	5.1	6.0	SRS Report 2020
2.	Under-five Mortality Rate (U5MR)	36.0	21.0	32.0	SRS Report 2020
		45.7	31.5	41.9	NFHS-5 (2019-21)
3.	Infant mortality Rate (IMR)	31.0	19.0	28.0	SRS Report 2020
		38.4	26.6	35.2	NFHS-5 (2019-21)
4.	Neo-Natal Mortality Rate (NNMR)	23.0	12.0	20.0	SRS Report 2020
		27.5	18.0	24.9	NFHS-5 (2019-21)
5.	Perinatal Mortality Rate	21.0	12.0	18.0	SRS Report 2020
6.	Still Birth Rate (SBR)	4.0	3.0	3.0	SRS Report 2020
7.	Maternal Mortality Ratio	-	-	97	SRS (2018-20)
8.	Maternal Mortality Rate	-	-	6	SRS (2018-20)
9.	Life Expectancy at Birth	68.6 (T) 67.2 (M) 70.1 (F)	73.2 (T) 71.9 (M) 74.5 (F)	70.0 (T) 68.6 (M) 71.4 (F)	SRS Abridged Life Table 2016-20
C.	Other Indicators				
1.	Unmet need for spacing (%)	4.3	3.5	4.0	NFHS-5 (2019-21)
2.	Unmet need for limiting (%)	5.6	4.9	5.4	NFHS-5 (2019-21)
3.	Total Unmet need (%)	9.9	8.4	9.4	NFHS-5 (2019-21)
4.	Contraceptive Prevalence Rate (CPR) any method (%)	65.6	69.3	66.7	NFHS-5 (2019-21)
5.	Mothers who had at least 4 antenatal care visits (%)	54.2	68.1	58.1	NFHS-5 (2019-21)
6.	Institutional births (%)	86.7	93.8	88.6	NFHS-5 (2019-21)
D.	Nutritional Status				
1.	Children under 5 years who are stunted (height-for-age) (%)	37.3	30.1	35.5	NFHS-5 (2019-21)
2.	Children under 5 years who are wasted (weight-for-height) (%)	19.5	18.5	19.3	NFHS-5 (2019-21)
3.	Children under 5 years who are underweight (weight-for-age) (%)	33.8	27.3	32.1	NFHS-5 (2019-21)
4.	Women who have high risk waist-to-hip ratio (≥ 0.85) (%)	55.2	59.9	56.7	NFHS-5 (2019-21)
5.	Men who have high risk waist-to-hip ratio (≥ 0.90) (%)	46.4	50.1	47.7	NFHS-5 (2019-21)
6.	Women with BMI < 18.5 kg/m ² (%)	21.2	13.2	18.7	NFHS-5 (2019-21)
7.	Men with BMI < 18.5 kg/m ² (%)	17.8	13.0	16.2	NFHS-5 (2019-21)
8.	Women with BMI ≥ 25.0 kg/m ² (%)	19.7	33.2	24.0	NFHS-5 (2019-21)
9.	Men with BMI ≥ 25.0 kg/m ² (%)	19.3	29.8	22.9	NFHS-5 (2019-21)

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