

Prevalence and predictors of multimorbidity in older adults, a community-based cross-sectional study

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ABSTRACT

Background: Multimorbidity is a condition that refers to the coexistence of two or more chronic diseases or long-term medical conditions in an individual. It has become one of the key issues in the public health sector, particularly among older adults. So, this study aimed to estimate the prevalence of multimorbidity and its associated factors among older adults. **Methodology:** The present study was a community-based cross-sectional study carried out on the elderly population (≥ 60 years) in a rural area of the study district, Gujarat. The estimated sample size was 384, and the final sample size was taken as 420, considering the multistage sampling procedure for fair distribution. The eligibility criteria included elderly people ≥ 60 years old, who were permanent residents (living for ≥ 6 months) of the study district and willing to participate in the study. Elderly people who were not willing to participate in the study for their reasons were excluded. A multistage sampling procedure was used to choose the study participants. The data collection tools included a pretested, predesigned, semi-structured questionnaire. The questionnaire consisted of two parts: sociodemographic details and morbidity details. Categorical variables were described by frequency and percentage, and numerical variables were described by mean \pm SD. Logistic regression analyses were applied to test the relationship of categorized independent and dependent variables, and all tests were two-tailed with statistical significance set at the probability value ($P < 0.05$). **Results:** Out of the 420 study participants, 52.1% were male and 47.9% were female, with a mean age of 70.70 years (SD \pm 8.18 years). The prevalence of multimorbidity was 50%, with males having a mean number of morbidities of 1.38 ± 1.06 and females having a mean number of morbidities of 1.44 ± 0.99 . As the age increased, the strength of association of multimorbidity also increased. Literacy level, marital status, occupation (business, farmer, housewife), and family history were statistically associated with multimorbidity in the study participants in both bivariate and multivariate analyses ($P < 0.05$). **Conclusion:** The study provides valuable insights into the health status of the elderly population in the rural area and can be used to inform healthcare policies and interventions aimed at improving the health outcomes of this population.

Keywords: Associated factors, elderly population, multimorbidity, rural area

Introduction

The World Health Organization's (1948) definition of health is "Health is a state of complete physical, mental and social well-being

and not merely an absence of disease or infirmity." The health of an individual is not a static process, while it is a dynamic phenomenon and a process of continuous change. At any given point in time, the health of individual changes in a range of spectrum varying from the highest point corresponding to the WHO definition of "positive health" to the lowest point of "death."¹

Aging results from the impact of the accumulation of a wide variety of molecular and cellular damage over time. This leads to

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Received: 23-11-2023

Revised: 01-12-2023

Accepted: 04-02-2024

Published: 28-06-2024

Access this article online

Quick Response Code:



Website:
<http://journals.lww.com/JFMPC>

DOI:
10.4103/jfmpe.jfmpe_1856_23

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How to cite this article: Damor N, Makwana N, Kagathara N, Yogesh M, Damor R, Murmu AA. Prevalence and predictors of multimorbidity in older adults, a community-based cross-sectional study. J Family Med Prim Care 2024;13:2676-82.

a gradual decrease in physical and mental capacity, a growing risk of disease, and ultimately death. Beyond biological changes, aging is often associated with other life transitions such as retirement, relocation to more appropriate housing, and the death of friends and partners.^[2]

By 2030, one in six people in the world will be aged 60 years or over. The share of the population aged 60 years and over will increase from 1 billion in 2020 to 1.4 billion in 2030. By 2050, the world's population of people aged 60 years and older will double (2.1 billion). While this shift in the distribution of a country's population toward older ages started in high-income countries, it is now low- and middle-income countries that are experiencing the greatest change. India's population is also experiencing a shift toward an older demographic. According to the United Nations, the number of people aged 65 years or over in India increased from 4.4% in 1990 to 6.6% in 2019 and is projected to reach 12.5% by 2050.^[3] Additionally, the number of people aged 60 years or over in India is projected to increase from 118 million in 2020 to 340 million in 2050. This shift toward an older population is expected to have significant impacts on India's healthcare system, workforce, and economy.^[2]

The government of India adopted the "National Policy on Older Persons" in January 1999. The policy defines "senior citizen" or "elderly" as a person who is of age 60 years or above.^[4]

Multimorbidity is a condition that refers to the coexistence of two or more chronic diseases or long-term medical conditions in an individual.^[3,5] It has become one of the key issues in the public health sector, particularly among older adults.^[3,5,6] Multimorbidity is associated with elevated risk of death, disability, poor functional status, poor quality of life, and adverse drug events.^[7] The prevalence of multimorbidity among older adults varies across countries, with rates ranging from 40.6% in Malaysia to 66.1% in high-income countries.^[8] The most prevalent multimorbidity patterns in older adults are cardiovascular, cardiometabolic, musculoskeletal, and mental disorders.^[5] The well-established associated factors of multimorbidity are biological and behavioral risk factors (e.g., elderly, female, overweight, smoking, drinking, and living alone) and various societal factors (e.g. household income, occupation, education, and living in a deprived area).^[3] The determinants of multimorbidity are complex and multilevel, including personal innate-, behavioral-, family and social network-, socioeconomic, and macroenvironmental factors.^[3] The health-ecological model is a useful framework for analyzing the potential factors associated with multimorbidity.^[3] The factors affecting older adults with multimorbidity were integrated into a multilevel health-ecological model, which includes personal innate-, behavioral-, family and social network-, socioeconomic, and macroenvironmental factors.^[3] The prevalence and patterns of multimorbidity among older adults vary across countries and regions, and the determinants of multimorbidity are complex and multilevel. Understanding the patterns and determinants of multimorbidity is crucial for developing comprehensive health management measures and promoting healthy and productive

aging. This information will help us plan the effective utilization of locally available resources for the health care of the geriatric population.

Methodology

The present study was a community-based cross-sectional study carried out on the elderly population (≥ 60 years) in a rural area of the study district, Gujarat, from June 2021 to January 2023. The sample size estimation was done by taking 80% power, 5% allowable error at 95% confidence interval, sample size (N) = $Z_{(1-\alpha/2)}^2 pq/L^2$, where

N = Desired sample size $Z_{(1-\alpha/2)}$ at 95% CI = 1.96, P = prevalence of morbidity in the study group (taken as 50% as per the WHO guideline of sample size estimation for research)

$$Q = (1 - p) = 50$$

L = Maximum allowable absolute error which is taken as 5% of $P = 25$, now the estimated sample size would be,

$$N = (1.96)^2 * 50 * 50/5^2 = 384.$$

The minimum required sample size is 384. Considering the multistage sampling procedure, for fair distribution, the final sample size will be taken as 420.

Eligibility criteria include

Inclusion criteria

- Elderly people ≥ 60 years old,
- Who were permanent residents of the study district,
- Who was willing to participate in the study.

Exclusion criteria

- Elderly people who were not willing to participate in the study for their reasons.

Sampling technique

- A multistage sampling procedure was used to choose the study participants, as depicted in Figure 1.
- In the first stage, three talukas were selected by lottery method out of six in the study district.
- The second stage consists of selecting two PHCs from each chosen taluka by simple random sampling.
- In the third stage; two subcenters from each chosen PHC were selected by simple random sampling
- Finally in the fourth stage, a list of households is obtained from registers kept at subcenters by using systemic random sampling; households were selected by using class interval which depends on the total number of households covered by that subcenter.
- If the selected household does not fit into the selection criteria, then the subsequent household is included in the study. In case more than one person is eligible for study as

per inclusion criteria in that case, only one person from that household is included.

Data collection tools and methods

- The instrument used during the study was:
 1. Pretested, predesigned, semi-structured questionnaire
 - Pretesting of tool: To see the feasibility of the topic to be covered under research, respondents to be interviewed, and testing the research instrument, a pretest carried out. Based on the responses provided by respondents, a few questions were modified, and very few were removed and added.
 - The questionnaire consisted of two parts:
 1. Sociodemographic details—This part was used for all sampled households. In this part, general information, like age, sex, religion, education, occupation, marital status, source of income, type of family, living arrangement, and details of health insurance, was included. Personal history, vitals, history, and family history regarding major illness were also included.
 2. Morbidity details—This part was used for all sampled households. In this part, information, regarding physical, social, and psychological morbidities, was included.
 - The Survey and Period of Data Collection:
 - After explaining in detail about the study, the data were collected from elder people by interview method using the above-mentioned data collection tools.

The interview was conducted in vernacular/Gujarati language, written informed consent from each participant was obtained, and all this procedure was conducted at the home of the participant.

Data from all the samples were collected (including pretest) in about ten months (November 2021–August 2022). The interview was completed in about average of 20–30 minutes, in one sitting at the convenience of the respondents.

Ethical clearance

- This study was started after getting ethical clearance from the Institutional Ethics Committee (REF No; 127/05/2021). The participant’s informed consent was obtained first after explaining the purpose of the study and that they were not obliged to answer any questions that they did not like or were free to terminate the interview at any given time. Assurance was given that the confidentiality concerning their information would be maintained strictly.

Statistical analysis

- Microsoft Office Excel-2019 and SPSS (version 26) were used for data analysis and preparation of graphs.
- Categorical variables were described by frequency and

percentage, and numerical variables were described by mean ± SD.

- Bivariate and multivariate logistic regression analyses were applied to test the relationship of categorized independent and dependent variables.
- All tests were two-tailed and statistical significance was set at the probability value ($P < 0.05$).

Results

Out of the total 420 study participants, more than half (52.1%) of the study participants were male and nearly half proportion of female 201 (47.9%). The observed mean age of study participants was 70.70 years (SD ± 8.18 years) and ranged between 60 and 108 years. The elderly in the study population were predominantly aged 60–69 years (51.2%), followed by about one-third (34.3%) of those aged 70–79 years, and 14.6% were 85 years or older [Table 1].

Only 74 (17.62%) of them were found to be economically independent, leaving 346 (82.38%) of them economically dependent on others for their daily needs. The dependent elderly mainly relied on their son (96.53%) or husband (3.47%) for their daily needs. While in independent elderly households, farming (51.36%) was the main source of income, followed by business (21.62%), laboring, and pensions (13.51% in each) [Summarized in Table 2].

From Table 3, it is evident that the majority, 108 (49%) of the males and females 103 (51%), suffered from multi-morbidities, while around one-fourth, 104 (25%) of them, had no morbidity and one-fourth, 105 (25%) of them, had single morbidity, respectively.

Table 4 depicts the distribution of morbidities by age group. Musculoskeletal issues were the most common

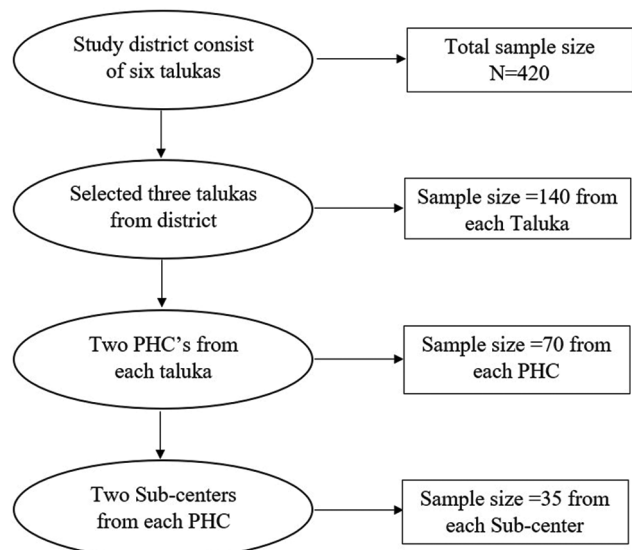


Figure 1: Shows the sampling technique of the study

Discussion

Table 1: The sociodemographic characteristics of the study participants

Variable (n=420)	Category	Frequency	Percentage
Age, (in years)	60–64	112	27
	65–69	103	24
	70–74	92	21.9
	75–79	52	12.4
	80–84	33	7.9
	≥ 85	28	6.7
Gender	Male	219	52.1
	Female	201	47.9
Religion	Hindu	394	93.8
	Muslim	26	6.2
Education	Illiterate	327	77.86
	Primary	91	16.67
	Secondary	15	3.57
	Higher Secondary	6	1.43
Marital status	Married	295	70
	Widow/widower	120	29
	Others*	5	1
Occupation	Business	016	03.81
	Farmer	122	29.05
	Laborer	018	04.29
	Housewife	172	40.95
	Retired and unemployed	092	21.90
	Business	016	03.81
Socioeconomic class (by modified BG Prasad classification)	Upper Class (I)	2	0.48
	Upper middle Class (II)	24	5.71
	Middle Class (III)	154	36.67
	Lower middle Class (IV)	208	49.52
	Lower Class (V)	32	7.62
Type of family	Nuclear family	31	7.38
	Joint family	66	15.71
	Three generation family	323	76.90
Living arrangement	Alone	8	1.90
	With spouse	16	3.81
	With children	111	26.43
	With children & spouse	285	67.86
Addiction history	Present	196	47
	Absent	224	53
Family history	Present	86	20
	Absent	334	80

morbidity found in the age groups 60–64 years (17.0%), 70–74 years (33.7%), and 75–84 years (47.1%). In the age group 65–69 years, hypertension (26.2%) was the most common morbidity. Visual impairment (46.4%) was the most common morbidity in the 85 years or older age group, followed by hypertension (39.3%), musculoskeletal issues (39.3%), and hearing impairment (35.7%).

Table 5 shows that as age increases the strength of association of multimorbidity also increases, literacy level (AOR-2.2), marital status (AOR-2.1), occupation [business (AOR-2.4), farmer (AOR-2.3), housewife (AOR-2.2)], and family history (AOR-3) were statistically associated with multimorbidity in the study participants in both bivariate and multivariate analyses ($P < 0.05$).

The study explores the pattern of morbidity and multimorbidity with its determinants in the elderly population. Morbidity was present in nearly three-fourths of females (78.11%) and males (72.60%); however, morbidity was found to be slightly higher among females than males. There was no statistically significant association observed between morbidity status and gender among the study participants ($P = 0.192$). Similar results were obtained in studies conducted by Usha *et al.*^[9] and Kumar *et al.*,^[10] in which a greater number of females had morbidities as compared to males. However, there was no statistically significant association observed.

Musculoskeletal problems were the most common morbidity among study participants (29.0%), followed by hypertension (20.7%), visual impairment (19.5%), gastrointestinal disorders (16.0%), and diabetes (11.7%). The least common morbidities were cancer (0.5%), followed by urinary problems (2.6%) and injury (3.3%).

The prevalence of chronic morbidities which are aging-related, like hypertension, visual impairment, musculoskeletal issues, gastrointestinal disorders, and hearing impairment was found to be more prevalent in higher age groups like 75–84 years and ≥85 years as compared to other younger age groups, while acute morbidities like cardiovascular problems, injuries, skin disease, and cancer were more distributed to younger age groups. This might be due to the difference in mortality and severity among the morbidities.

Similar findings were recorded by Mini *et al.*,^[11] in which the most common morbidities found were arthritis (30.6%), hypertension (21.0%), and visual impairments (12.9%), the least common morbidities were cancer (0.4%) and dementia (0.9%). Gladius Jennifer *et al.*, George *et al.*, and Verma and Mishra^[12-14] all found in their study that the most common morbidity among the elderly was musculoskeletal disorder.

According to the search results, several studies have investigated the prevalence of multimorbidity in older adults. The Lancet^[15] reports that the prevalence of multimorbidity among adults in community settings ranges from 12.9 to 95.1%, depending on the age group and the number of chronic diseases investigated. A previous study^[16] found that the prevalence of multimorbidity among older adults in Malaysia was 57.1%. A Systematic Review of Prevalence Studies on Multimorbidity^[17] observed marked differences across studies in the estimated prevalence of multimorbidity. The prevalence of multimorbidity among older adults from both cross-sectional and prospective studies was between 15.8% and 80.8%. Another study^[18] reported that the prevalence of multimorbidity in European community-dwelling adults aged 50 and over who reported two or more noncommunicable conditions was approximately 33%. Another study^[19] found that 34.70% of patients with chronic disease suffered from multimorbidity. The prevalence

of multimorbidity in older adults varies widely across studies and depends on the age group, the number of chronic diseases investigated, and the study population. Therefore, it is important to consider these factors when comparing the prevalence of multimorbidity across studies.

Also, the study found that older age, marital status, occupation, family history, and literacy were associated with multimorbidity, which is similar to the previous study which shows a similar association with multimorbidity. One study found that lower socioeconomic status and education level were well-established risk factors for multimorbidity.^[20] Another study found that age, gender, and living in urban areas were associated with multimorbidity in older adults in India.^[21] A systematic review identified several social determinants of multimorbidity patterns,

including age, gender, marital status, socioeconomic status, and behavioral factors such as lifestyles.^[22] Previous studies have also found associations between age and multimorbidity. The study mentioned in the initial query found that literacy level, marital status, occupation, and family history were associated with multimorbidity.^[23,24]

Recommendation

Administrative levels

1. Integrated Health Screening Programs:

Elderly patients should undergo regular screenings for hyperglycemia, hypertension, cardiovascular diseases, and other physical ailments, irrespective of their apparent health condition. Implementing systematic and periodic screenings at administrative levels will contribute significantly to the timely diagnosis of various noncommunicable and degenerative diseases. This initiative requires coordination across healthcare institutions, government health departments, and policymakers.

2. Enhanced Infrastructure for Elderly Healthcare:

Establish a dedicated management and monitoring unit for the National Program for the Health Care of the Elderly (NPHCE), operating independently from the current National Chronic Disease Program. This administrative restructuring will strengthen the program, ensuring a more focused approach to elderly health care. Adequate resources and personnel should be allocated to this unit, reflecting the growing importance of elderly health in national health agendas.

3. Financial Support Systems:

Recognizing the financial dependence of the elderly population, governments should strategically plan and implement comprehensive financial aid programs. These initiatives should specifically target the elderly, providing essential financial support for their daily routine expenses, including medications. Administrative bodies, such as social welfare departments, should collaborate with healthcare and financial institutions to design and implement effective support systems.

Table 2: Distribution of study participants based on economic dependency

Economic variable	Frequency	Percentage
Distribution by economic dependency (n=420)		
Dependent	346	82.38
Independent	74	17.62
Distribution by source of income (n=74)		
Farming	38	51.36
Labor	10	13.51
Business	16	21.62
Pension	10	13.51
Distribution by source of dependency (n=346)		
Children	334	96.53
Husband	12	3.47

Table 3: Distribution of study participants by multimorbidity and gender

Variables	Number of morbidities			
	0 (%)	1 (%)	Multimorbidity (≥2) n (%)	T (%)
Male	60 (28)	51 (24)	108 (49%)	219 (52)
Females	44 (22)	54 (27)	103 (51%)	201 (48)
Total	104 (24.76)	105 (25)	211 (50.24%)	420 (100)

Table 4: Distribution of study participants according to morbidities and age group

Morbidities	Age group (years)				
	60–64 (n=112)	65–69 (n=103)	70–74 (n=90)	75–84 (n=85)	≥85 (n=28)
Cardiovascular problem	5 (4.5)	7 (6.8)	7 (7.6)	7 (8.2)	2 (7.1)
Hypertension	18 (16.1)	27 (26.2)	17 (18.5)	14 (16.5)	11 (39.3)
Skin disease	4 (3.6)	6 (5.8)	1 (1.1)	4 (4.7)	1 (3.6)
Diabetes	10 (8.9)	7 (6.8)	17 (18.5)	10 (11.8)	5 (10.2)
Cancer	0 (0)	0 (0)	2 (2.2)	0 (0)	0 (0)
Musculoskeletal Issue	19 (17.0)	21 (20.4)	31 (33.7)	40 (47.1)	11 (39.3)
Urinary problem	3 (2.7)	0 (0)	4 (4.3)	1 (1.2)	3 (10.7)
Respiratory problem	6 (5.4)	4 (3.9)	9 (9.8)	8 (9.4)	4 (14.3)
Gastrointestinal disorder	9 (13.4)	12 (11.7)	13 (14.1)	23 (27.1)	10 (35.7)
Hearing impairment	0 (0)	0 (0)	2 (2.2)	22 (25.9)	10 (35.7)
Injury	4 (3.6)	4 (3.9)	4 (4.3)	2 (2.4)	0 (0)
Visual impairment	3 (2.7)	14 (13.6)	20 (21.7)	32 (37.6)	13 (46.4)
Others	5 (4.5)	9 (8.7)	19 (20.7)	19 (22.4)	10 (35.7)

Numbers in parenthesis indicate percentages. *Multiple answer

Table 5: Association between sociodemographic characteristics and multimorbidity

Variable (n=420)	Category	COR, CI	AOR, CI
Age, in year	60–64	[1]	[1]
	65–69	3.3 (1.7–6.2)	3.2 (1.6–6.2)**
	70–74	9.3 (4.8–18)	9.3 (4.4–19.7)**
	75–79	19.4 (8.4–44)	20 (7.5–53)**
	80–84	19.3 (7.3–51)	18.8 (6.4–55)**
	≥ 85	141 (18–161)	133 (15.6–166)**
Gender	Male	[1]	
	Female	0.9 (0.6–1.36)	
Religion	Hindu	[1]	
	Muslim	1.6 (0.7–3.69)	
Literacy	Literate	[1]	
	Illiterate	3.5 (2.1–5.9)	2.2 (1.2–3.07)*
Marital status	Married	[1]	
	Widow/widower	2.7 (1.7–4.3)	2.1 (1.8–3.5)*
	Separated/divorced	5.3 (1.2–48)	2.47 (1.9–38)*
Occupation	Business	5.5 (1.7–4.3)	2.4 (1.2–5.8)*
	Farmer	3.7 (2.1–6.7)	2.2 (1.19–3.0)*
	Laborer	2.1 (1.2–5.7)	1.8 (0.9–7.2)
	Housewife	2.8 (1.6–5)	2.3 (1.23–7)*
	Unemployed	[1]	
	Socioeconomic class	Upper Class (1,2)	[1]
Lower Class (3,4,5)		0.5 (0.2–1.16)	
Type of family	Nuclear family	[1]	
	Joint family	2.4 (1.12–5.8)	1.2 (0.2–5.6)
	Three generation family	1.5 (0.7–3.27)	
Living arrangement	Alone	2.1 (1.2–9)	1.1 (0.01–15)
	With spouse	0.7 (0.2–2.7)	
	With children	2.6 (1.6–4.2)	0.89 (0.19–4)
	With children & spouse	[1]	
Addiction history	Present	1.02 (0.69–1.49)	
	Absent	[1]	
Family history	Present	2.45 (1.83–4.55)	2.92 (1.66–5.25)*
	Absent	[1]	[1]

P<0.05*, P<0.001**, analyses were carried out by multivariate logistic regression

Community levels

1. Promotion of Holistic Well-being through Yoga and Meditation:

Community-based initiatives should focus on promoting activities like yoga and meditation. These practices contribute to maintaining mental health and can potentially slow down the progression of degenerative diseases. Community centers, local healthcare providers, and nonprofit organizations can collaborate to organize classes, workshops, and awareness campaigns to encourage the adoption of these beneficial practices among the elderly population.

2. Community Engagement in Health Promotion:

Foster community engagement in the health and well-being of the elderly. Local community organizations, neighborhood associations, and volunteers can play a vital role in creating awareness about the importance of regular health check-ups, screenings, and the benefits of a healthy lifestyle. Community-level interventions should emphasize preventive healthcare measures and encourage a supportive environment for the elderly within neighborhoods.

3. Social Support Networks:

Communities should actively work toward creating and strengthening social support networks for the elderly. This includes initiatives to connect the elderly with available resources, support groups, and community services. By building a sense of community and shared responsibility, neighborhoods can contribute to the overall well-being and quality of life of their elderly residents.

Limitation

- As the current study was descriptive and cross-sectional, only the association of some sociodemographic determinants could be demonstrated, but the causality of the sociodemographic determinants could not be determined.
- Many of the elderly did lack birth records, so it was challenging to determine their exact ages.
- The monthly incomes revealed by participants were not cross-checked with official records.
- We recorded the self-reported morbidities; all the morbidities were recorded as perceived by the elderly population and no

clinical or diagnostic tests were done to confirm or refute the same.

Conclusion

The prevalence of multi-morbidity was observed to be high in the study population. So, it is necessary to develop a multilevel “individual-community-government” system management plan to handle the multimorbidity of elderly patients, older individuals who have several conditions, and certain disease association combinations that require urgent care.

Acknowledgments

We acknowledge and are grateful to all the patients who contributed to the collection of data for this study. We are also thankful to Dr. Nandini Desai (Dean and Chairman of MDRU and Dr. Dipesh V Parmar (Professor and Head, Department of Community Medicine) of our institute—Shri M P Shah Government Medical College, Jamnagar, India.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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