

## Original Research Article

# Assessment of risk scoring of non-communicable diseases among doctors in a medical college of Navi Mumbai: a cross sectional study

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## ABSTRACT

**Background:** Doctors are supposed to lead healthier lifestyles and are usually assumed to have lower morbidity and mortality rates than general population due to their medical knowledge. However, recently a study conducted by the research cell of Indian Medical Association concluded that doctors die younger and mostly due to cardiovascular diseases.

**Methods:** A cross sectional study was conducted among 100 doctors in a medical college for duration of 3 months. Questionnaires were distributed, they were personally interviewed and required clinical examination was done. Data obtained was tabulated in MS Excel and analyzed using SPSS software. Risk of cardiovascular diseases, diabetes, stroke and obesity was estimated and its association with various determinants was seen.

**Results:** Odds of having central obesity increases 10 times with body mass index (BMI)  $\geq 25$  kg/m<sup>2</sup> as compared to  $< 25$  kg/m<sup>2</sup>. With risk ratio of 1.96, doctors are twice at risk of having BMI  $\geq 25$  as compared to general population. Number of people with higher risk of cardio vascular disease increased after 45 years of age. People with at least one non communicable disease (NCD) outnumbered the people without any NCD, in the age group of 45-54 years and above. Insufficient physical activity is prevalent among 37% in this age group.

**Conclusions:** This study gives an idea on impact of medical profession on lifestyle, outlook and attitude towards personal health among professional doctors. Initiatives must be taken to identify the causes of professional stress among doctors and measures must be taken to prevent them.

**Keywords:** Non-communicable diseases, Doctors, Professional stress, Cardio-vascular risk

## INTRODUCTION

Medical profession is one of the most stressful profession out there in the society today. Increased stress levels are one of the most important risk factors for many non-communicable diseases (NCDs). Doctors are supposed to lead healthier lifestyles and are usually assumed to have lower morbidity and mortality rates than general population due to their medical knowledge. However, recently a study conducted by the research cell of Indian Medical Association concluded that doctors die younger and mostly due to cardiovascular diseases.<sup>1</sup> Factors such as long working hours, lack of physical activity, sleep

deprivation, faulty food habits, addictions and less pay are causing work life imbalance. These risk factors are influencing the physical and mental stress levels, thus indirectly affecting health status among doctors. Probability of such factors having an impact on health status of doctors cannot be ruled out. Higher risk of having non-communicable diseases among doctors has been documented by studies done before.<sup>2</sup> You don't have to do dangerous jobs like working in a coal mine or on a construction site, to endure a health destroying and possibly life threatening work place. Personal well-being and organizational work environment should change for a better work life balance and to ensure good health among

doctors. Hence there is a need to relate impact of professional stress on health among doctors. In order to know how the medical profession affects health status of doctors, this study was planned.

### Aims and objectives

- Estimating the prevalence and risk factors associated with common NCDs among doctors.
- To estimate the determinants and distribution of various risk factors associated with NCDs among doctors.

## METHODS

**Study design:** Cross-sectional study.

**Study setting:** A medical college and tertiary care hospital of Navi Mumbai.

### Study duration

The study was conducted between September 2018 and December 2018 (4 months). Permission from Institutional Review Board (IRB) was taken for the study.

Twenty departments (8 pre, para-clinical, 12 clinical) were included in the study. Out of 170 odd total faculty post MD/MS working in the medical college, for good representation of the population a convenient sample of 100 was taken in the ratio of 2:3 i.e., 40 from pre-para clinicals, 60 from clinicals. For fair departmental representation a minimum sample of 50% from each department was selected randomly. Validated questionnaires were distributed to all selected doctors. The questionnaire included the information such as designation, age, sex, department, history of any NCDs, addictions, physical activity, sleep pattern, mental stress, family history of NCDs etc. They were personally interviewed and required clinical examination was done. Anthropometric measurements like weight was measured by a standard weighing scale, height, waist and hip circumference were taken by a measuring tape and Blood Pressure was measured using sphygmomanometer (As per WHO STEPS guidelines).<sup>3</sup> The details of all the past investigations required for estimating the risk of common NCDs were taken. Faculty who refused to give consent was excluded. Confidentiality was maintained with all the information that was collected. Risk scoring of cardiovascular diseases (Framingham criteria), stroke,

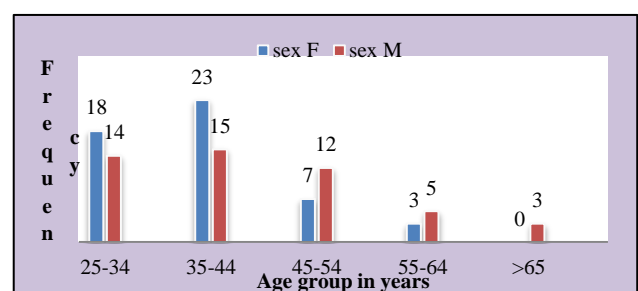
diabetes using IDRS (Indian Diabetes Risk Score) and metabolic syndrome was done.<sup>4-7</sup> Data obtained was tabulated in MS Excel and analyzed using SPSS software.

### Inclusion and exclusion criteria

Only post MD/MS faculty working in the medical college and hospital were included. Faculty who refused to give consent was excluded.

## RESULTS

Out of total 100 participants, 51% were females and 49% were males. Mean age was 41 yrs with standard deviation (SD) of 9.75 years. Age and sex wise distribution is shown in the (Figure 1).



**Figure 1: Age and sex wise distribution.**

### Body mass index

Overall mean of body mass index (BMI) of faculty was 26.22 kg/m<sup>2</sup> with SD of 3.28, men 26.68 kg/m<sup>2</sup> with SD of 3.14, women 25.78 kg/m<sup>2</sup> with SD of 3.38. Sex wise distribution of subjects as per detailed classification of various categories of BMI is shown in the (Table 1). When National Family Health Survey (NFHS) 4 data for BMI  $\geq 25$  was compared with the study data, the following conclusion was inferred. Percentage of females with BMI  $\geq 25$  in India are 31.3%, in Maharashtra are 32.4% and in this study it was 62.7%. Percentage of males with BMI  $\geq 25$  in India are 26.6%, in Maharashtra are 31.2% and in this study it was 61.3%. Percentage of people with overweight and obesity was significantly higher in the study population as compared to the general population. The study population has twice higher risk of having BMI  $\geq 25$  than general population with the risk ratio of >1.96.

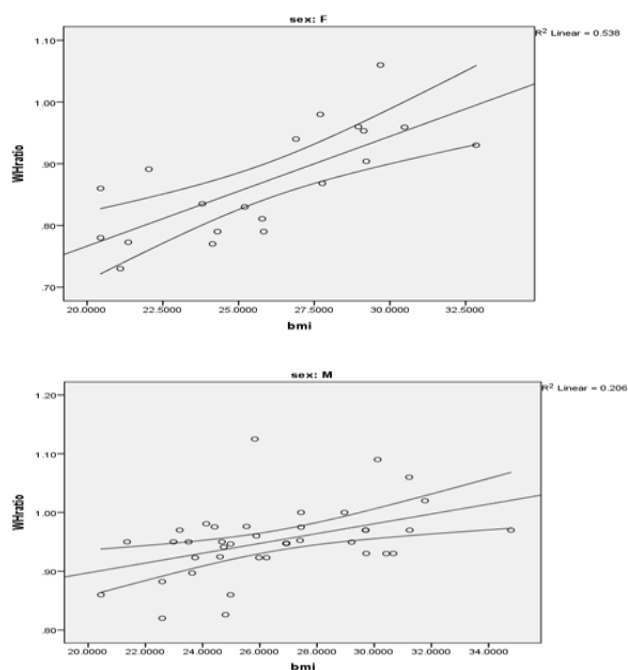
**Table 1: Sex-wise distribution of BMI group.**

Sex*BMI cross tabulation		BMI group				Total
		Undernourished	Normal	Overweight	Obesity	
Sex	F <sup>a</sup>	Count	0	19	27	51
		%	0.0	37.2	52.9	100.0
	M <sup>b</sup>	Count	0	19	21	49
		%	0.0	38.8	42.9	100.0
Total	Count	0	38	48	14	100
	Total (%)	0.0	38.0	48.0	14.0	100.0

<sup>a</sup>=Female, <sup>b</sup>=Male

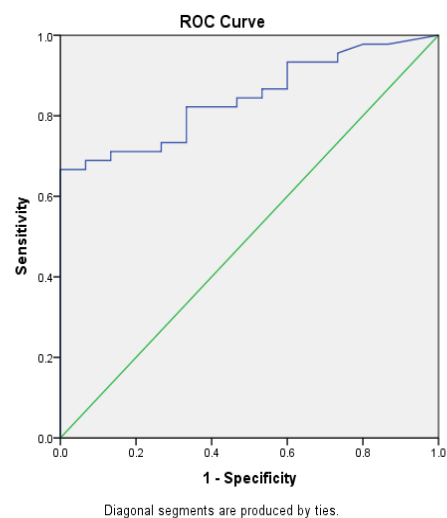
### Waist hip ratio (measure of central obesity/adiposity)

Waist hip ratio  $>0.9$  in men or  $>0.85$  in women is termed as central obesity (As per WHO diagnostic criteria for diagnosis of metabolic syndrome). Waist hip ratio of all the faculty who agreed (60 out of 100) to provide measurements has been documented in the study. Overall mean waist hip ratio of faculty was 0.925 with SD of 0.08. (For women it was 0.87 with SD of 0.09 and for men it was 0.952 with SD of 0.059). Among those doctors whose waist hip was measured (60 out of 100), 55% of women and 85% of men had central obesity. There is a significant positive correlation between BMI and Waist Hip ratio ( $p<0.01$ ) Pearson Correlation coefficient (R) was 0.733 with  $p<0.000$  in females and Pearson Correlation coefficient (R) was 0.454 with  $p$  value of 0.003 in males (Figure 2). It was also noted that, by applying binary logistic regression over “presence or absence of central obesity” vs BMI, 39.7% predictor in variance (R squared value = 0.397) in presence or absence of central obesity could be described by variation in BMI ( $p=0.001$ ).



**Figure 2: Correlation between BMI and waist hip ratio.**

A crosstab showing the relationship between presence or absence of central obesity with the BMI group  $<25$  (non obese) and  $\geq 25$  (obese) is shown in the (Table 2). Pearson Chi-Square value = 12.091 with P-value of 0.001 and odds ratio is 9.84. This implies that a person with BMI of  $\geq 25$  has around 10 times higher odds of having central obesity than that of someone with BMI  $<25$ . We can also see that alpha error here is  $3/35 = 0.08$  or 8%. By increasing the cut off from 25 to 26, alpha error becomes zero. i.e., people with BMI of  $>26$  are almost certain of having central obesity. In the sense, BMI of more than 26 picks up central obesity with high specificity. With the intention to find out the exact cut off value of BMI for the presence or absence of central obesity, binary logistic regression was applied and ROC curve was plotted (Figure 3). Area under the curve was 0.843 (99% CI: 0.716-0.970,  $p<0.001$ ). From this study, the model predicted that at the cut off value of BMI  $\geq 25.857$ , the sensitivity was 0.667 and 1-specificity (false negatives) was  $<0.001$ . This implies that anyone with a BMI of more than 25.857 is certain to have central obesity as per the sex wise cut offs of waist hip ratio for the same. So, this could be taken as a cut off tool to predict central obesity by just calculating BMI. Since the average BMI is 26.22 in the study group, it could be concluded that central obesity is a highly prevalent risk factor.



**Figure 3: ROC curve of BMI predicting central obesity.**

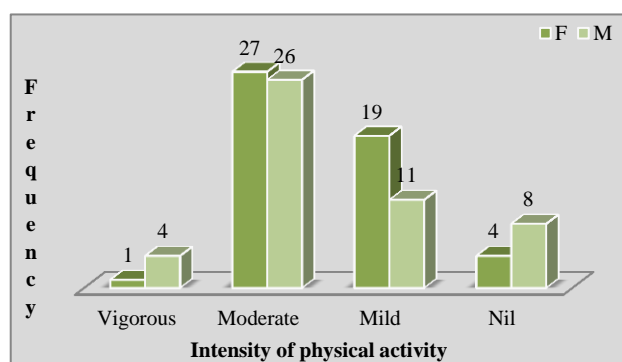
**Table 2: Central obesity vs BMI group crosstab.**

Central obesity * BMI group cross tabulation			BMI group (kg/m <sup>2</sup> )		Total
			<25 (Non obese)	≥25 (Overweight/obese)	
Central obesity	No	Count	12	3	15
		%	80.0	20.0	100.0
	Yes	Count	13	32	45
		%	28.9	71.1	100.0
Total		Count	25	35	60
		%	41.7	58.3	100.0

### Physical activity

WHO defines intensity of physical activity as follows: >6 METs (metabolic equivalents) - vigorous, 3-6 METs - moderate, <3 METs - mild and nil - no physical activity.<sup>8</sup> As per the data provided by the faculty in this study, the intensity of physical activity was classified according to the IDRS (Indian Diabetes Risk Score) grading (Figure 4).<sup>6</sup> Sufficiency of physical activity (according to the WHO criteria) is compared with age group (Table 3) where it was found that 39% were insufficiently physically active.<sup>9</sup> The table also shows age group wise distribution of past history of NCDs. Here it was noticed that the number of subjects with at least one NCD outnumbered the subjects without any disease in the age group 45-54 and above. So, interventions before this age (<45 years) aimed at preventing the onset of NCDs would reduce the disease burden in a big way. Few other

important parameters which are risk factors for NCDs were assessed (Table 4).



**Figure 4: Distribution according to the intensity of physical activity.**

F: Females; M: Males.

**Table 3: Physical activity sufficiency and past history of NCDs with age group.**

			Age group in years					Total
			25-34	35-44	45-54	55-64	>65	
Physical activity sufficiency	Insufficient	Count	15	15	7	1	1	39
		%	46.90	39.50	36.80	12.50	33.30	39.00
	Sufficient	Count	17	23	12	7	2	61
		%	53.10	60.50	63.20	87.50	66.70	61.00
	Total		32	38	19	8	3	100
Past history of NCDs	Females	No	15	20	3	1	-	39
		Yes	3	3	4	2	-	12
	Total		18	23	7	3	-	51
	Males	No	13	15	4	2	0	34
		Yes	1	0	8	3	3	15
	Total		14	15	12	5	3	49

**Table 4: Frequency of few other important risk factors potentially causing NCDs.**

Parameter	Present (%)	Comment
Subjective feeling of mental stress	14	Most common reason -professional
Do not get enough sleep	18	<8 hours per day
Habits/ addictions	26	Either alcohol consumption or smoking
Past history of NCDs	27	At least one NCD present

### Cholesterol - HDL ratio

26 out of 51 females (51%), 18 out of 49 males (36.7%) have not done their lipid profile in last 1 year. Mean age of investigation not done category is "37.8 years" with SD of 8.1years. Although the difference isn't statistically significant, this study shows females are more likely to skip investigations/annual check-ups. Out of the total 44 who did not have their lipid profiles done, 26 (59.1%) busy schedule, 8 (18.2%) I feel it's not important, 9 (20.5%) I don't have risk factors, 1 (2.3%) due to carelessness. Among the doctors who have done the investigations, the results are as follows: Among females 7 (28%) had normal cholesterol HDL (C-HDL) ratio and 18 (72%) had high C-HDL ratio. Among males 6 (19.4%)

had normal C-HDL ratio and 25 (80.6%) had high C-HDL ratio. Overall percentage with normal C-HDL ratio was 23.2% and high C-HDL ratio was 76.8%. Cholesterol HDL Ratio of 3.5 was taken as the cut off for both males and females, as per AHA guidelines.<sup>10</sup> Inferences from Framingham study about C-HDL ratio are mentioned. C-HDL ratio at half the average risk: 3.3 for females (F), 3.4 for males (M); C-HDL ratio with average risk of Heart disease: 4.4 (F), 5 (M); C-HDL ratio at double the avg risk: 7 (F), 9 (M). Mean cholesterol-HDL ratio for females was 3.81 with SD of 0.74 and for males was 3.65 with SD of 0.6. Mean age of females whose lipid profile was done= 40.6 years with SD of 8.2 years. Mean age of males whose lipid profile was done =41.7 years with SD of 9.8 years. A total of 30 out of 56 (53.6%) people have

higher cholesterol HDL ratio than ideal recommendations. Although cumulative risk of CVD appears to be more in men, seems like they're doing better with C-HDL ratio compared to women.

### Cardiovascular disease risk

Age and sex wise distribution of cardiovascular disease risk according to Framingham criteria was tabulated (Table 5).

**Table 5: 10-year risk in % according to Framingham criteria vs age group and sex.**

Sex		Age group (in years)						Total
		25-34	35-44	45-54	55-64	>65		
Female	10-year risk in % according to Framingham criteria	<1	3	15	1	-	-	19
		1	-	-	4	-	-	4
		2	-	-	1	1	-	2
		Inv ND*	15	8	1	2	-	26
	Total		18	23	7	3		51
Male	10-year risk in % according to Framingham criteria	<1	7	5	-	-	-	12
		1	1	5	-	-	-	6
		2	-	-	1	-	-	1
		4	-	-	2	-	-	2
		8	-	-	1	-	-	3
		10	-	-	1	-	1	2
		12	-	-	-	1	-	1
		16	-	-	-	1	-	1
		20	-	-	-	1	1	2
		25	-	-	-	-	1	1
			Inv ND*	6	5	7	-	-
	Total		14	15	12	5	3	49

\*Inv ND = investigation not done.

**Table 6: Risk of hypertension and diabetes.**

Sex		Female		Male		Total
Morbidity		Count	Percentage (%)	Count	Percentage (%)	
Hypertension	Normal	20	39.20	26	53.10	46
	Pre hypertension	24	47.10	16	32.70	40
	Hypertension	7	13.70	7	14.30	14
Diabetes risk	Low	7	13.70	5	10.20	12
	Moderate	22	43.10	26	53.10	48
	High	17	33.30	12	24.50	29
	Diabetes	5	9.80	6	12.20	11

### Hypertension and stroke

Out of the total study population 46% were having normal blood pressure, 40% were pre hypertensive and 14% were hypertensive (Table 6). This was calculated according to AHA guidelines 2017.<sup>11</sup> Mean age of people with pre hypertension is 38.8 years with a SD of 7.8 years. Mean age of people with hypertension is 49.1 years with a SD of 12.3 years. There is no significant difference between males and females. Risk of stroke according to National Stroke Association (USA) risk score card was: 89% low risk, 11% caution.<sup>5</sup>

### Risk of diabetes mellitus and metabolic syndrome

Out of the total study population 12% were at low risk, 48% medium risk, 29% high risk of diabetes and 11%

were having diabetes mellitus (Table 6). Mean age of people with medium risk of DM is 37.9 years with a SD of 7.7 years. Mean age of people with high risk of DM is 45.2 years with a SD of 8.9 years. There is no significant difference between males and females. 26% of the study group had insulin resistance (15% were pre diabetic and 11% diabetic) out of which three of them were at risk of metabolic syndrome. The mean age of people who were resistant to insulin was 51 years with a SD of 9 years.

### DISCUSSION

Aim of this study was to assess the pattern of risk factors of NCDs among doctors, whether professional stress adds up and lead to additional risk of having NCDs among them or is there no significant difference as compared to general population. Prevalence and risk of cardiovascular

diseases, hypertension, stroke, diabetes and metabolic syndrome was estimated. Parameters such as body mass index, waist hip ratio, physical activity, cholesterol HDL ratio and few other important predictors of NCDs were assessed.

Prevalence of BMI  $\geq 25$  was significantly higher than national average of NFHS 4 survey. A study by Sara N. Bleich et al conducted a survey on 500 primary care physicians which showed that BMI  $\geq 25$  was found in 53% of the physicians.<sup>12</sup> Prevalence of the same in our study is 62%. Slightly higher prevalence is seen in our study comparatively because the above quoted had a comparatively younger physician population, also that the study was done on primary care physicians as compared to post graduates and above in our study. This could also imply that the longer duration of professional stress increases the prevalence of higher BMI. Waist Hip ratio is a predictor of myocardial infarction.<sup>13</sup> Overall average prevalence of increased waist hip ratio in our study is around 70%, which is higher than general community average for the same. The prevalence in a study conducted by Singh et al on general population was 64.8%, indicating that doctors are more prone for having higher waist hip ratio and thus its complications as well.<sup>14</sup> A relation between BMI and waist hip ratio was established. It was found that a BMI of 25.857 or more is certain to have central obesity. Since the average BMI in the study population is higher than this, the study has population higher risk of central obesity and cardio vascular morbidity. The association is proven beyond doubt in the many studies such as Mhurchu et al where continuous positive association was established between baseline BMI and the risks of ischaemic stroke, haemorrhagic stroke, and IHD, with each 2 kg/m<sup>2</sup> lower BMI associated a 12% (95% CI: 9, 15%) lower risk of ischaemic stroke, 8% (95% CI: 4, 12%) lower risk in haemorrhagic stroke, and 11% (95% CI: 9, 13%) lower risk of IHD.<sup>15</sup>

The study results showed insufficient physical activity in two fifth of the subjects, which could be because of their busy schedule. It can be inferred that regular physical activity before chronic NCDs sets in would help postponing the onset of such diseases. It is also suggested by WHO's global strategy on diet, physical activity and health, Waxman.<sup>16</sup>

Overall around 45% of the doctors had not done their routine investigations due to stressful routine and busy schedule. Among those who had got their investigations done in the past one year, prevalence of abnormal lipid profile was seen in 54% of the doctors. In a study by Raj et al it was found that in urban population, dyslipidemia was present in 74.5% people.<sup>17</sup> Although current study shows lesser prevalence than the quoted study, the prevalence of 54% is an alarming situation.

Prevalence of mental stress was found to be 14% in our study. Consistent with this finding, occupational stress has been identified in several studies as a risk factor for

mental breakdown and burnouts and may have influence on work capacity.<sup>18-20</sup> Other factors that we studied were sleep deprivation (18%) and habits/addictions (26%).

Based on these above parameters, risk scoring of important NCDs was done. It was estimated that the prevalence of Diabetes mellitus was 11% and Hypertension was 14% (Table 6). In a study conducted by Hegde et al, prevalence of Diabetes mellitus was found to be 25.4% and that of hypertension was 29.4% among doctors.<sup>21</sup> Prevalence in our study was comparatively lower because of different cut offs/ guidelines followed for estimation of the diseases. Mean age of people with Pre hypertension was found to be 38.8 years. Mean age of people with medium risk of diabetes mellitus was 37.9 years. Mean age of those who did not do investigations in the past 1 year was 37.8 years. It was also noticed that the number of subjects with at least one NCD outnumbered the subjects without any disease in the age group 45-54 years and above (Table 3). Hence, interventions aimed at the group of population between 35 and 40 years of age or before, may reduce the NCD burden and also prevent their early onset.<sup>22</sup>

### Limitations

Framingham risk score and the NSA risk score used in the study to calculate CVD risk and stroke risk are useful for American population. So, certain discrepancies are expected to occur when used on Indian population. Samples were collected only from one medical institute. Since there are many significant findings in this study, there is a need to conduct such studies with larger samples in a multi centric manner across the country, to further generalize it to the population of medical fraternity. Findings were not significantly different between pre-para clinical faculty and the clinical faculty. In order to derive department wise conclusions, a larger study is recommended.

### CONCLUSION

This study gives an idea on impact of medical profession on lifestyle, outlook and attitude towards personal health among professional doctors. Initiatives must be taken to identify the causes of professional stress among doctors and measures must be taken to prevent them.

### Recommendations

Initiatives must be taken to identify the causes of professional stress among doctors and measures must be taken to prevent them. Medicos go through years of exam stress, exhaustive physical and mental workload, with lower pay-scale, busy schedule, accompanied by higher workload subsequently hampering their health. Higher salary packages could be helpful.

Constant motivational sessions must be organized among doctors to ensure regular investigations, practice of recommended physical activity and control of other risk

factors to prevent early aging, early occurrence of NCDs and early death.

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## REFERENCES

- George Jacob. Do doctors die young, and why? The Hindu Newspaper article. December 09, 2017. Available at: <https://www.thehindu.com/opinion/open-page/do-doctors-die-young-and-why/article21381601.ece>. Accessed 20 November 2019.
- Survey: 50% doctors at risk of cardiovascular diseases. Times of India Newspaper article Dec 16, 2016. Available at: <https://timesofindia.indiatimes.com/life-style/health-fitness/health-news/survey-50-doctors-at-risk-of-cardiovascular-diseases/articleshow/56015199.cms> Accessed 20 November 2019.
- WHO. Non-communicable diseases and their risk factors. Surveillance. STEPwise approach to surveillance (STEPS). User manual. Available at <https://www.who.int/ncds/surveillance/steps/manual/en/> Accessed 20 November 2019.
- Framingham Risk score. Available at: [https://en.wikipedia.org/wiki/Framingham\\_Risk\\_Score](https://en.wikipedia.org/wiki/Framingham_Risk_Score) Accessed 20 November 2019.
- Stroke Risk Scorecard. National Stroke Association guidelines 2018. Available at: <https://www.stroke.org/stroke-risk-scorecard-2018/>. Accessed 20 November 2019.
- The Indian Diabetes Risk Score (IDRS). Available at: <http://www.cadiresearch.org/topic/diabetes-indians/the-indian-diabetes-risk-score> Accessed 20 November 2019.
- Metabolic Syndrome: A Growing Clinical Challenge: Diagnosis. Medscape. Available at: [https://www.medscape.org/viewarticle/484166\\_4](https://www.medscape.org/viewarticle/484166_4) Accessed 20 November 2019.
- WHO. Global Strategy on Diet, Physical Activity and Health. Available at: [https://www.who.int/dietphysicalactivity/physical\\_activity\\_intensity/en/](https://www.who.int/dietphysicalactivity/physical_activity_intensity/en/) Accessed 20 November 2019.
- WHO. Global Strategy on Diet, Physical Activity and Health. Physical Activity and Adults. Available at: [https://www.who.int/dietphysicalactivity/factsheet\\_adults/en/](https://www.who.int/dietphysicalactivity/factsheet_adults/en/) Accessed 20 November 2019.
- New ACC/AHA High Blood Pressure Guidelines Lower Definition of Hypertension 2017. American College of Cardiology. Available at: <https://www.acc.org/latest-in-cardiology/articles/2017/11/08/11/47/mon-5pm-bp-guideline-aha-2017> Accessed 20 November 2019.
- Understanding the Cholesterol Ratio: What It Is and Why It's Important. Available at: <https://www.healthline.com/health/cholesterol-ratio> Accessed 20 November 2019.
- Sara N, Bleich, Wendy L. Bennett Kimberly A. Gudzone Lisa A. Cooper. Impact of Physician BMI on Obesity Care and Beliefs; Obesity. 2012;20:999-1005.
- Cao Q, Yu S, Xiong W, Li Y, Li H, Li J, et al. Waist-hip ratio as a predictor of myocardial infarction risk A systematic review and meta-analysis. Medicine (Baltimore). 2018;97(30):PMC6078643.
- Mhurchu CN, Rodgers A, Pan WH, Gu DF, Woodward M, Parag V, et al. Body mass index and cardiovascular disease in the Asia-Pacific Region: An overview of 33 cohorts involving 310 000 participants. Int J Epidemiol. 2004;33(4):751-8.
- Singh M, Kotwal A, Mittal C, Babu SR, Bharti S, et al. Prevalence and correlates of hypertension in a semi-rural population of Southern India. J Human Hypertension. 2018;32:66-74.
- Waxman A. WHO's global strategy on diet, physical activity and health. Scandinavian J Nutr. 2004;48(2):58-60.
- Ajay Raj S, Sivakumar K, Sujatha K; Prevalence of dyslipidemia in South Indian adults: an urban-rural comparison. Int J Community Med Public Health. 2016;3(8):2201-10.
- Kaur S, Sharma R, Talwar R, Verma A, Singh S. A study of job satisfaction and work environment perception among doctors in a tertiary hospital in Delhi. Indian J Med Sci. 2009;63(4):139-44.
- Lemaire JB, Wallace JE. Burnout among doctors - a system level problem requiring a system level response. BMJ. 2017;358.
- Bernburg M, Vitzthum K, Groneberg DA, Mache S. Physicians' occupational stress, depressive symptoms and work ability in relation to their working environment: a cross-sectional study of differences among medical residents with various specialties working in German hospitals. BMJ Open. 2016;6(6):e011369.
- Hegde SKB, Sathiyarayanan S, Venkateshwaran S, Sasankh A, Ganeshkumar P, Balaji R. Prevalence of Diabetes, Hypertension and Obesity among Doctors and Nurses in a Medical College Hospital in Tamil Nadu, India. National J Res Community Med. 2015;4(3):235-9.
- WHO. Noncommunicable diseases and mental health. NCD tools. Available at: <https://www.who.int/nmh/ncd-tools/en/> Accessed 20 November 2019.

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